TM-0563

INSTRUCTION MANUAL

FOR

18 FOOT WEATHER RADAR ANTENNA

AND MODIFIED CPS-9 DISPLAY SYSTEM

SIERRA
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BUFFALO, NEW YORK

TECHNICAL MANUAL 0563

INSTRUCTION MANUAL FOR 18 FOOT WEATHER RADAR ANTENNA AND MODIFIED CPS-9 DISPLAY SYSTEM

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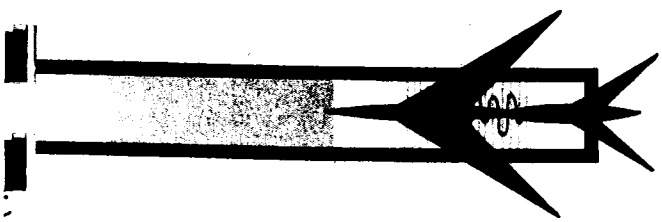

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SECTION I
INTRODUCTION

This Instruction Manual describes the modifications and additions made to the SCR-584 Antenna Pedestal and CPS-9 Display Console.

Basically, the entire system is composed of the following:

1. 18-Foot solid skin parabolic antenna complete with feed.
2. SCR-584 Pedestal.
3. Pedestal tower.
4. Nitrogen pressurization system.
5. Antenna positioning servo system.
6. CPS-9 Display Console and ranging system.

Reference is made to TM11-1524 Instruction Manual for the theory of operation of the SCR-584 Pedestal, antenna positioning servo amplifier and amplidyne.

Theory of operation of the indicator display group may be found in the CPS-9 Instruction Handbook.

To familiarize operating and maintenance personnel, a brief description of the sub-system modifications which were performed by Sierra Research Corporation follows. It will also be noted, at this point, that a more detailed explanation of the following units will be provided in other sections of this manual.

A. ANTENNA PEDESTAL MODIFICATIONS

The basic modifications performed to the original SCR-584 pedestal are as follows:

1. Replacement of the original rigid coax with new RF-48/U waveguide.
2. Installation of a new anti-backlash gear in the elevation synchro gear assembly.
3. Providing a gear ratio change of B2051 synchro from 16:1 to 1:1 ratio.
4. Replacement of the original SIN/COS data pot with a Gamewell Type RL-14.

5. Replacement of Size 5 with new Size 23 synchro adapters.

6. Installation of new elevation limit switches, cam, and micro switches.

7. Installation of new azimuth and elevation rotary joints.

B. PEDESTAL TOWER

In order to allow the use of an 18-foot dish, a 65-inch tower section is provided. This tower is shown in figure 1 .

C. J-BOX

To facilitate system wiring, a J-box has been provided. This unit is mounted on the antenna tower and has a removable cover for relay and diode servicing.

Located at the bottom of the J-box are five connectors; two of which are used for the azimuth and elevation amplidynes. The remaining three connectors carry all the signal and power functions between the modified CPS-9 console and the pedestal.

A cabling drawing of the J-box is shown in figure 1 .

D. SUPPLIED CABLES

Two sets of split cables have been provided. These cables, designated as CA-1 and CA-2, connect from the top of the J-box to the bottom of the SCR-584 pedestal.

E. NITROGEN PRESSURIZATION SYSTEM

In order to prevent high voltage arcing in the waveguide due to the possible accumulation of moisture, a nitrogen tank, regular unit, and alarm switch have been provided.

In order to provide room for the antenna positioning servo amplifier circuitry and new ranging system, certain portions of the CPS-9 ranging system were removed.

Units of the CPS-9 console which were modified or replaced are as follows:

1. CPS-9 "B" indicator was rebuilt into a CPS-9 RHI indicator.

2. The original CPS-9 ranging system was replaced with a new system calibrated in kilometers.

3. New azimuth and elevation positioning readouts accurate to 0.1 degrees were provided.

4. New closed loop velocity amplifiers are provided in both the azimuth and elevation channels.

5. Complete integration of the SCR-584 antenna positioning circuitry into the CPS-9 console has been provided.

The above-mentioned equipment and modifications will be discussed in detail in a later chapter.

SECTION II
INSTALLATION INSTRUCTIONS

A. UNPACKING

Carefully uncrate all packages of shipment to insure that all of the following items are present: (Refer to figure 1.)

1.	(1 each)	18-foot antenna assembly and all hardware listed in antenna assembly instructions and drawings.
2.	(1 each)	Modified SCR-584 pedestal.
3.	(1 each)	65-inch tower section and J-box assembly.
4.	(1 each)	500-pound counterweight assembly.
5.	(2 each)	Rotary joints (azimuth and elevation).
6.	(1 each)	Waveguide section with 0 to 30 PSI gauge.
7.	(1 each)	Pressurization IRIS assembly.
8.	(1 each)	Nitrogen pressure tank.
9.	(1 each)	Pressure regulator unit.
10.	(1 each)	Pressure switch assembly
11.	(1 each)	Pressure hose assembly.
12.	(2 each)	Amplidyne motor generator unit.
13.	(2 each)	J-box to pedestal jumper cables.
14.	(1 each)	Modified CPS-9 console.

B. 18-FOOT ANTENNA ASSEMBLY INSTRUCTIONS

1. After unpacking all components, visually inspect for shipping damage.
   a) Dish surface should be free from dents and scratches.
   b) Waveguide free from dents.
   c) Flanges of waveguide free from nicks.

2. Place both reflector halves on a level surface with the joint lines opposite each other. A small piece of plywood should be placed under the hub halves to protect this interface.

3. Using ten 1/2" bolts (items 12, 13, 14 and 15), bolt the reflector halves together. Care should be taken to see that the alignment pins in one reflector half are in mating holes properly before tightening bolts. Then securely tighten all ten bolts. Put items 11 and 12 into place and secure.

4. To insure the best possible alignment, the horn and horn ring are shipped assembled. The horn is also pinned in position.

Feed support spars marked "1" and "2" are now attached to the horn ring using 5/16" hardware. (Items 16, 17, 18 and 19.) This is done with spars horizontally on the ground and with the horn ring on edge. Now attach guys 3 and 4 to the horn ring.

This assembly may now be carried by four men to the dish and all four studs fitted to the appropriately marked pads extending from the dish perimeter.

5. A 2" x 12" plank or a scaffold at least 20' long (capable of supporting the weight of one man) should now be placed across the aperture of the dish and supported on each side so that it does not place any weight on the antenna structure. The scaffold supports should be placed one each near spar pad "1" and spar pad "2".

6. After spars and guys are secured tightly in place, waveguide clamps 44-7-G1 and 44-7-G2 may be secured to the approximate position shown on drawing 44-8.

7. Put waveguide section 44-4-G1 in place using item 25 (gasket) between the waveguide flange and horn flange. Attach hardware (items 21, 22, 23 and 24) finger-tight. Push waveguide into brackets until dimension between straight end and spar is 2". Now hardware at horn may be tightened evenly. Tighten clamps lightly to hold waveguide in place.

CAUTION: DO NOT OVER-TIGHTEN AND CAUSE DISTORTION IN WAVEGUIDE.

8. Waveguide piece 44-4-G2 may now be put in place using gasket and hardware, and using existing clamp on reflector. Leave these interfaces finger-tight until reflector is raised to pedestal and final waveguide section 44-4-G3 is trimmed for proper fit to rotary joint.

9. Remove scaffold and supports.

10. Using the recommended sling attachment position, the dish may now be raised to the pedestal and secured by eight 1/2" bolts.

C. ORIENTATION OF PEDESTAL TO TOWER

When mating the pedestal to the tower, position the red index mark,painted on the pedestal,over the red index mark on the tower. This will position the connectors located at the bottom of the pedestal so that they are as close to the top of the J-box as possible. In other positions, the pedestal to J-box cables may not have sufficient length to provide proper connections.

D. FINAL INSTALLATION

After all items have been accounted for, it is a simple matter to assemble and cable the entire antenna and positioning system as shown in figure 1 .

All mounting hardware has been provided, except bolts to mount the tower base to the radome mounting pad. All hardware, with the exception of the antenna hardware, will be found loosely fitted in its respective mounting hole.

E. PEDESTAL POSITIONING WITHOUT POWER

In order to move the antenna pedestal manually in azimuth and elevation, a handcrank is provided.

After locating the azimuth and elevation drive motors, remove the plugs at the end of the motor drive shaft and attach the supplied handcrank. The pedestal can now be manually moved in any desired position.

F. SUGGESTED INSTALLATION PROCEDURE

Installation should be performed in the following manner:

1. Assemble entire antenna.
2. Bolt tower section to radome mounting pad.
3. Install pedestal to tower section, observing red index marks.
4. Hand crank elevation to 0 degrees.
5. Install antenna (observing proper lifting points).
6. Install counterweights.
7. Attach cables to J-box (figure 1).

8. Assemble pressurization assembly (figure 1).

9. Assemble radome.

G. LEVELING ANTENNA SYSTEM

After installation is complete, hand-crank antenna to 90° elevation. Observe right angle levels located at top left side of the elevation terminal board housing. Level system by installing jack screws located next to each mounting bolt. Insert hand crank in azimuth drive motor, rotate antenna in azimuth and observe readings of levels. Make correction by means of the proper jack bolt.

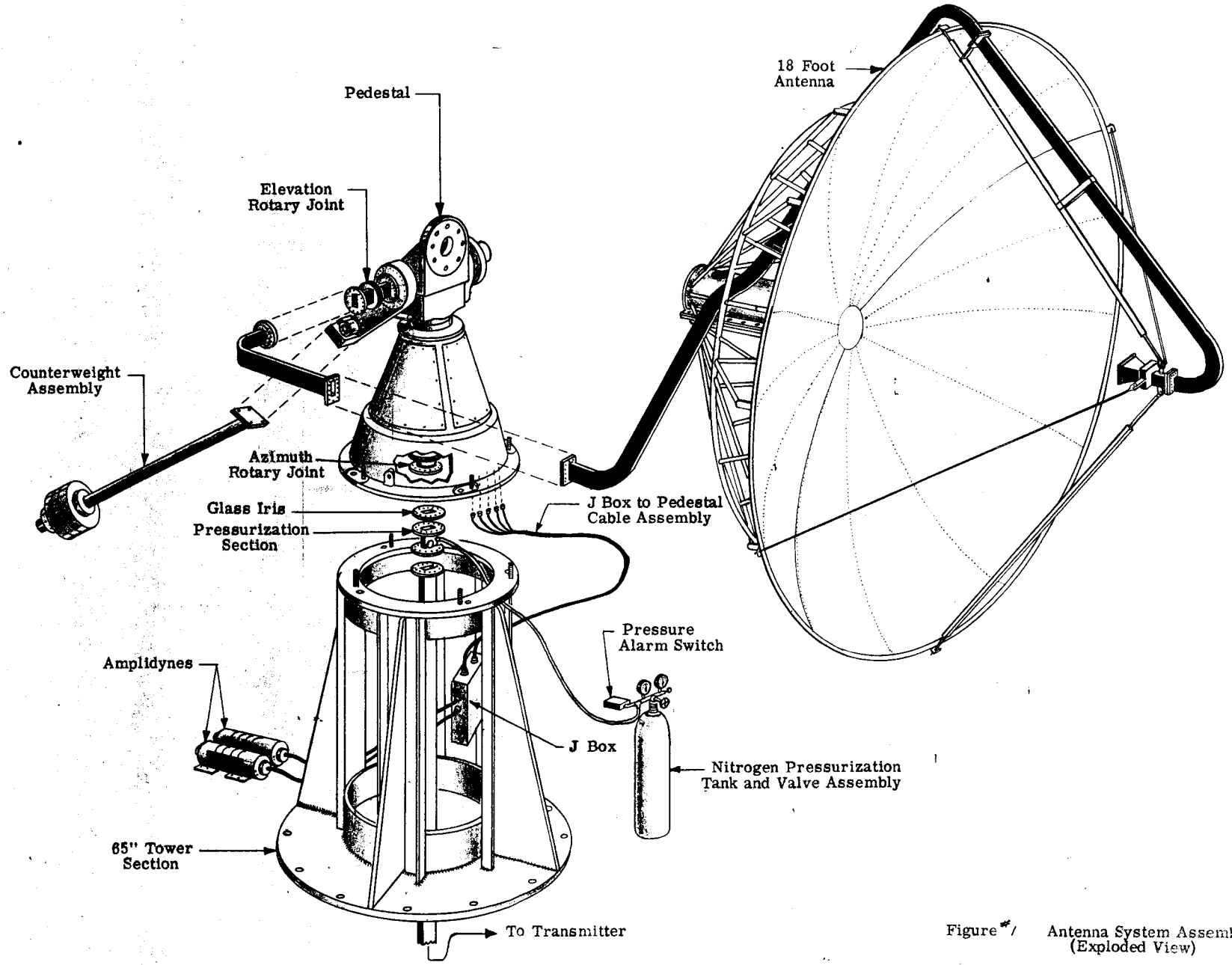


Figure #/ Antenna System Assembly
(Exploded View)

SECTION III
POWER REQUIREMENTS

A. SYSTEM A-C WIRING

Two a-c power sources are required in order to energize the antenna and display systems:

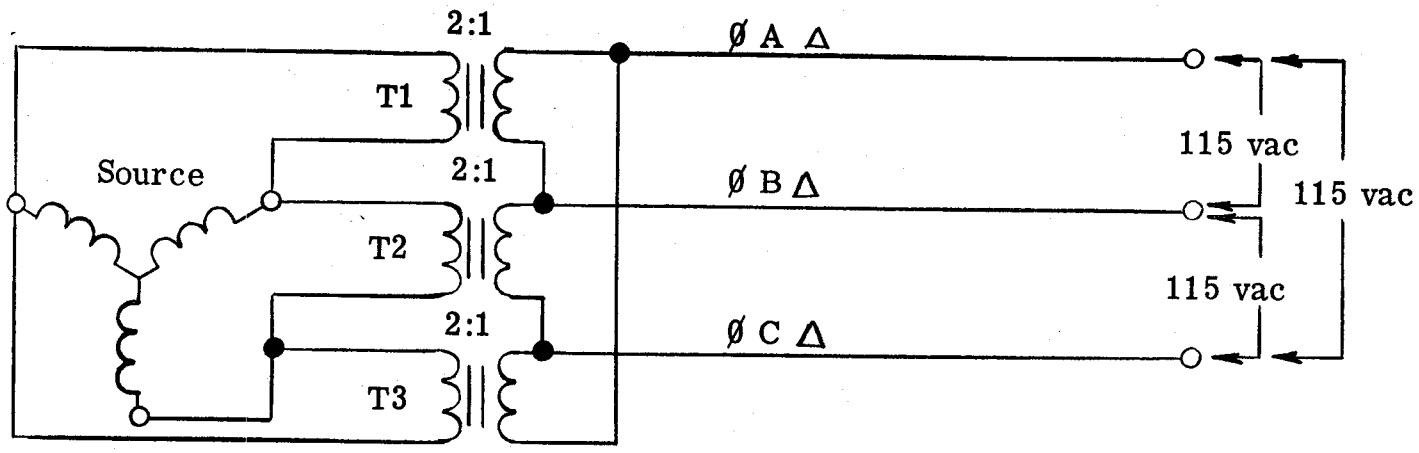
1. Antenna System

   115-vac line-to-line 3-phase, 3-wire, 60-cycle, at 3-kva total.
   Note: No neutral.

2. Modified CPS-9 Display Console

   115-vac single phase, 60-cycle at 15 amp.

If commercial 220-vac line-to-line Wye power only is available, the following hook-up is suggested to provide the necessary Delta requirement:



A suggested transformer for T1 thru T3 above would be:

Westinghouse

Catalog No.	3E66
Type:	EP Single-Phase Transformer
Style:	S20N11516
Voltage:	240 x 480 to 120/240
Ratio:	2 to 1
Rating:	1 kva
Approximate Cost:	$33.00 each

B. POWER CONNECTIONS

Connections for both a-c power sources are made directly to the CPS-9 console. The a-c power is then distributed from the console to all required points.

The required 3-phase Delta power is connected directly to terminal board TB #9 , located on left center console bottom.

A power connector for the single-phase source is located on the right lower center bulkhead. Pin connections for this connector are found in figure .

Six connections from terminal board TB #10 , located in the console, will supply a-c power to the amplidynes located at the radome. The cable running from this terminal board to the J-box should be a separate cable containing six No. 14 gauge wires or heavier.

SECTION IV
TURN-ON PROCEDURE AND SYSTEM OPERATION

A. CUSTOMER-SUPPLIED CABLES

Two cables which must be supplied by the customer for system operation are as follows:

1. Signal Cable: Consisting of 58 each No. 16 wires.

2. Power Cable: Consisting of 6 each No. 14 wires.

These two above cables run from their respective terminal boards located in the CPS-9 console up to the J-box located in the radome.

WARNING: All cables should be tested to insure correct wiring and hook up before power is applied to the system.

B. INITIAL TURN ON PROCEDURE

1. Before the above mentioned cables have been installed between the console and the J-box, make sure all switches located at the console are in the "off" position.

2. With 3-phase Delta power applied to TB #9 of the console, check with an a-c voltmeter connected from line-to-line, to insure that 115-vac, 60-cycle is present.

3. Turn main power circuit breaker to the "on" position. All three power indicators should light.

4. Turn elevation and azimuth amplidyne switches, located directly below RHI indicator No. 2, to the "on" position. With both of these switches left in the "on" position, it will be necessary to check each amplidyne to insure proper direction of rotation.

If amplidynes are not rotating properly, change any two phases of input Delta power at TB #10 at the console. Note: Be sure all switches are turned off at console when changing connections.

5. After proper amplidyne rotation has been determined, turn all switches in console to "off" position and then proceed as follows:

a) Main power circuit breaker to "on".

b) Field supply switch to "on". Lamp should light.

c) Plate B+ switch to "on". Lamp should light. If lamp does not light, refer to figure 2 B+ interlock circuitry, for possible open interlock switch at pedestal.

d) With step "c" above complete, turn Rate X switch to "on". Lamp should light.

e) The elevation and azimuth error meters on the range and data readout panel should both indicate approximately 2.5 vdc. If meters do not indicate 2.5 vdc, turn the azimuth and/or elevation positioning hand wheel(s) so both meters indicate properly.

f) Turn amplidyne switch to "on". Allow antenna to find correct azimuth null as indicated by a sudden change in the azimuth error meter. When the antenna has found the correct null, the meter will again read 2.5 vdc.

g) Note: Always allow at least a three-second interval when switching on individual amplidynes. If this is not done, it is possible to trip the main circuit.

h) Turn elevation amplidyne switch to "on" while observing elevation error meter. If meter begins to move from 2.5 v position, turn amplidyne off immediately, and proceed to crank elevation hand wheel in one direction until the meter indicates 2.5 vdc. There are four possible nulls in the elevation channel.

C. AZIMUTH AND ELEVATION SCAN MODE

When it has been determined that the system is functioning properly in the manual mode, the following procedure may be followed:

1. Turn azimuth speed control to extreme CCW position. Turn azimuth scan switch to the "on" position. Turn speed control to 2 rpm position.

2. Energize CPS-9 console power switch. After 30 seconds, a sweep should appear on the PPI indicator (providing a trigger pulse has been provided to the console). Check for rotation of PPI sweep as well as movement azimuth position readout located on the range and data panel.

CAUTION: When stopping the antenna in the scan mode, always turn speed control to extreme CCW before turning switch to "off" position. (This comment also applies to the elevation scan channel.)

3. With antenna azimuth rotation stopped, place elevation scan control to the extreme CCW position. Turn elevation scan switch to the "on" position. Place scan limit switch to the 60° position. Turn elevation speed control to 2°/sec. position. Antenna should scan up to 60° as indicated by the elevation readout located on the range and data panel. Antenna will reverse itself at 60° and proceed downward until the lower limit is reached at -2°. The antenna again will reverse direction and continuously repeat this cycle.

4. With antenna scanning in elevation, turn scan limit switch to 40° position. Antenna will now scan up to 40°.

5. Turn scan switch to 20° position. Antenna will now scan up to 20°.

D. NORMAL SYSTEM TURN-ON

After system has been initially checked out, system turn-on procedure may be simplified as follows:

1. Leave field supply, plate B+, and rate X switches in the "on" position.

2. Turn main power circuit breaker and CPS-9 console power switches to "on" position.

3. Turn respective azimuth and elevation amplidyne switches to "on" position.

E. CPS-9 TURN-ON

Only one switch is required to turn on the CPS-9 console indicator group. Operation is straight forward and reference is made to the CPS-9 operation instruction handbook.

F. B+ SAFETY INTERLOCK CIRCUITRY

As shown in figure 2 , the phase A,115-vac line leaves the pedestal power supply at J2-J. It thus connects the CPS-9 console, thru the system J-box, to the pedestal. At the pedestal, two switches are provided. These are safety switch S2001 and azimuth stow switch S2002. Safety switch S2001 is located inside the azimuth gimbal and can readily be seen when the inspection cover is removed. This switch is for protection of maintenance personnel and should be placed in the safety position when work is being done at the radome location. The azimuth stow switch is located on the pedestal azimuth gimbal and is normally used only during transportation.

As seen in figure 2 , if all switches are on and all cables are connected, the 115-vac, phase A hot line will be fed back from the pedestal to J2-K of the pedestal power supply and energize relay K1. This will then allow +300 vdc to be applied to the SCR-584 positioning amplifier.

It will also be noticed in figure , that the same phase A hot interlock line is used for the elevation control relays and limit switches. This feature gives additional elevation limit protection.

G. ELEVATION AND AZIMUTH MANUAL ANTENNA POSITIONING

Handwheels are provided for antenna positioning in both channels. No switching is required, to change from the scan to manual modes of operation.

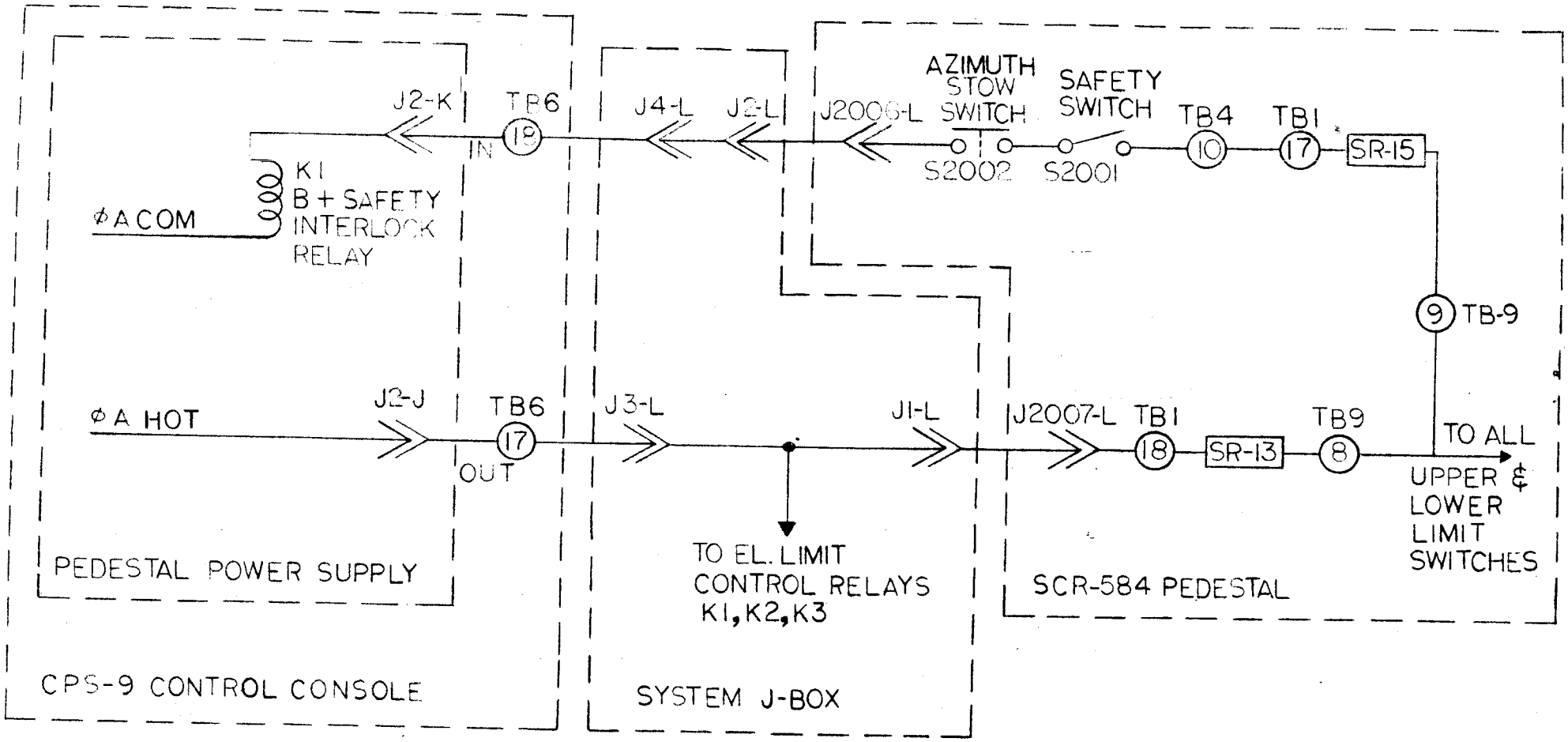


FIGURE 2 B+ SAFETY INTERLOCK

SECTION V
ANTENNA SYSTEM THEORY OF OPERATION

A. ANTENNA PEDESTAL AND JUNCTION BOX

The SCR-584 pedestal, as modified by Sierra Research Corporation, contains the basic mechanical modifications as outlined in Section I.

Figure 3 is the complete schematic of this pedestal and is self-explanatory. Figure 3 is the wiring diagram of the J-box which serves as the main distribution section for all equipment located in the radome. All signals between the console and the equipment in the radome are distributed through this J-box.

Shown in figure 4 is a block diagram of the antenna pedestal synchro system as modified by Sierra Research Corporation. This block diagram shows the elevation and azimuth mechanical axis of the pedestal and the respective gearing ratio for each synchro housing. These synchros provide positioning and readout data.

The SCR-584 pedestal is geared in both the azimuth and elevation channels and are driven by 1/2 horsepower D. C. motors in a typical Ward Leonard configuration. Spare slip rings in the elevation gimbal are available and can be located by reference to figure 3 .

B. ROTARY JOINTS AND PRESSURIZATION UNIT

Two in-line type rotary joints have been provided. These joints are identical except for the type of flange. The elevation joint uses choke flanges and the azimuth joint uses cover plate flanges.

The pressurization system contains a nitrogen tank, regulator unit, and pressure alarm switch, and functions as follows.

The nitrogen regulator unit has two gauges. One gauge indicates the amount of nitrogen pressure remaining in the tank; the second gauge indicates the regulated pressure supplied to the wave guide. The line pressure to the wave guide is controlled by a valve located on the regulator proper. With the regulator valve turned all the way out (CCW), no nitrogen is allowed to enter the wave guide.

To put pressure into the wave guide system, the regulator valve should be adjusted clockwise until the line gauge indicates approximately 20 P. S. I. The line gauge on the regulator should be checked against the gauge located on the wave guide pressure section to which the output line is connected.

When the pressure in the wave guide drops below 18 P. S. I., the pressure alarm switch closes and applies +28 vdc to the buzzer located at the console alarm panel. The operator thus has an audible warning that wave guide pressurization is failing.

C. ANTENNA SYSTEM POWER DISTRIBUTION

1. Main Power Circuit Breaker Panel

With the 3-phase Delta power connected to TB9 of the console, power is now applied to the line side of the 3-phase, 20-ampere circuit breaker located on the main power panel of the console. (See figure 5 schematic.) When this breaker is turned to the "on" position, power is applied to the a-c power and distribution panel.

This type of circuit breaker will open if any one of the three phases draws more than 20 amperes.

2. A-C Power Distribution and Fuse Panel

This panel contains the necessary fuses for all units of the antenna positioning system. All fuse holders on this panel are made in such a way that if a fuse should happen to blow, the fuse holder will light, thus indicating trouble in that designated area.

There are two switches associated with this panel, designated S6 and S7 (refer to figure 6 schematic). These switches control power to the azimuth and elevation amplidynes.

Power from this panel is also distributed to the scan rate and the alarm panels of the console.

3. Scan Rate Panel

The scan rate panel is located directly in the center of the CPS-9 console and is shown in the schematic of figure 7 . This panel contains all the antenna scan controls and associated circuitry for both azimuth and elevation channels. Also located on this panel are plate B+ switch S1, field supply Switch S2, and rate excitation switch S3. Switches S1 and S2 control single phases a-c to the pedestal power supply transformer primaries located in the pedestal power supply. Switch S3 applies phase B power to the azimuth and elevation velocity

amplifiers, rate transformers T1 and T2, and to the azimuth and elevation velocity servo drive motors located on the motor drive unit. A pigtail connector, J8, is also provided from this panel. J8 connects to both the normally open and normally closed contacts of both the elevation upper limit relay K2 and the elevation lower limit relay K3.

These relays energize only when the antenna reaches the upper and lower elevation limits and thus provides a means of controlling cameras or other auxiliary equipment to be used with the system.

4. Pedestal Power Supply

Located in the rear of the CPS-9 console is the pedestal power supply. The schematic of this unit is shown in figure 8 .

When the plate B+ switch and the field switch, which are located on the scan rate panel, are on primary power is applied to transformers T1 and T3 respectively. It will be noticed that the plate B+ switch also applies phase A power to the servo reference transformer T3. Transformer T3 is the positioning servo reference for the positioning servo only.

The servo plate supply produces +300 vdc, +75 vdc, and 6.3 vac, respectively. These output voltages,along with the previously mentioned 115-vac phase A servo reference,are applied directly to the SCR-584 positioning servo amplifier.

It will be noted that the ground for this supply is carried by a single wire and is eventually grounded in the positioning servo amplifier. Also shown in figure 8 is K1, the B+ interlock relay. This relay is a safety device and will be energized only when all interlocks in the antenna pedestal are closed. This interlock circuitry is shown in figure 2 .

The field supply associated with transformer T3 supplies unfiltered +280 vdc to the field windings of the antenna azimuth and elevation drive motors.

5. +28 VDC Power Supply

Shown in schematic figure 9 is the 28-vdc,7-amp power supply. This unit is located at the rear of the console in the center section. The +28 vdc output of this unit furnishes power to the following three units:

1. 28 vdc to 115 vac 400-cycle inverter.

2. Azimuth and Elevation positioning readouts.

3. Pressure alarm buzzer.

Primary power for this unit is 115 vac, single phase, and is energized when the console main power circuit breaker is turned on.

The primary sides of transformer T1 are fused at the console alarm panel location.

6. +28 VDC to 115 VAC 400-Cycle Converter

This unit is also located at the rear center section of the console. When +28 vdc is applied to this motor generator unit, it produces 115 vac, single phase, 400 cycle, which is required for the azimuth and elevation position readout synchros located in the pedestal. Single-phase, 400-cycle power is also applied to the azimuth and elevation position readout units located at the range and data readout panel.

The 115 vac output of this unit is fused at the rear panel of the console.

D. ANTENNA POSITIONING SERVO SYSTEM

To provide maintenance personnel with a usable knowledge of the positioning servo system, the following block diagram analysis has been made.

1. Description of Manual Antenna Positioning Mode

Since both azimuth and elevation positioning channels operate identically, only the elevation channel will be discussed. Referring to block diagram, figure 10 , movement of the antenna in elevation takes place when the elevation handwheel located on the console front panel is turned. This handwheel is mechanically geared to the rotor of a transmitting synchro located in the elevation positioning unit. When the handwheel is turned, an error voltage is produced in the synchro stator leads.

The phase of this signal will determine the direction and the amplitude, how far in that direction the antenna will move. This error signal is then fed from the transmitting synchros to a differential synchro located in the azimuth and elevation motor drive unit. The output of the differential synchro is then fed to the stator of a synchro control transformer located in the elevation gimbal of the pedestal. Since the rotor of the control transformer is geared to the pedestal, it cannot move.

The error signal then present at the rotor terminals is fed back to the elevation channel of the SCR-584 positioning servo amplifier. This signal is compared in phase with a reference signal to determine proper direction of antenna rotation. After phasing has been determined, the a-c peak-to-peak amplitude of the error signal is essentially rectified and filtered. This + or - d-c error is then fed to a pair of 6L6 push-pull amplifiers. The plate output winding for the 6L6 tubes is located at the amplidyne. The direction of antenna rotation is determined by which 6L6 is conducting the hardest. The amount of conduction will determine how far the antenna will turn. The output of the amplidyne is a low voltage, high current source which feeds the elevation drive motor, and thus turns the antenna. When the antenna turns, the rotor of the elevation control transformer will also turn and reduces the error signal on the rotor to zero, thus balancing the servo loop.

2. Description of Scan Antenna Positioning Mode

Both the azimuth and elevation scan modes of operation are essentially identical with the exception of the necessary elevation upper and lower limit circuits.

As seen in block diagram figure 10 , both shafts of the azimuth and elevation synchro differentials are mechanically coupled to their respective servo motors. These servo motors, when driven from their respective velocity amplifiers, will rotate the shafts of the differentials and cause the antenna to be rotated. The velocity servo amplifiers operate in a completely closed loop configuration by means of a degenerative feedback. This a-c feedback signal is obtained from a-c tachometers which are geared to their respective servo motors.

To illustrate the scan mode of operation, reference is made to the scan rate panel of figure 10.

It will be noted that both transformers T1 and T2 are excited by 115-vac phase B. This voltage is the velocity servo reference for both channels. The secondaries of these transformers feed their respective series voltage divider networks. In the case of the azimuth channel, resistor R7 serves as the azimuth speed control. When the azimuth scan switch S5 is placed in the ON position, the error voltage from the arm of R7 is applied to the input of the azimuth velocity amplifier. The phase of this signal will determine in what direction the servo

motor and differential rotor will rotate and the amplitude of the signal, as determined by the position of resistor R7 arm, will determine what speed the motor will rotate. In the case of the azimuth channel, the antenna phase is fixed and will always rotate in the clockwise direction. It should be noted in figure 10 that two other sections of switch S5 apply phase B 115 vac to the reference winding of the azimuth servo motor.

The same operating configuration also holds true for the elevation channel, with the exception that the antenna must be reversed in direction at the upper and lower limits. This antenna reversal is simply accomplished by the use of relay K1. Relay K1 operates every time the lower limit or a selectable upper limit switch is energized, and thus reverses the phase of the secondary of transformer T1.

As noted in figure 10 , four upper limit scan angles can be selected by switch S6. If the antenna switch is left in the OFF position, the antenna will scan from a lower limit of -2° to an upper limit of +90° in elevation. In all other positions of switch S6, the upper limit is as shown in figure .

3. Modified SCR-584 Positioning Servo Amplifier

This unit, as modified by Sierra Research, is shown schematically in figure 11 . It is located in the lower right hand compartment of the console as viewed from the rear. Modifications to this unit consist of the following:

1. Placing the field current error meters M1 and M2 permanently in the azimuth and elevation channels respectively, and relocating meter to the range and data unit front panel.

2. Rewiring of the unit to eliminate the original automatic/manual relays K401 and K402.

For a detailed, as well as a block diagram theory of the operation of the servo amplifier, reference is made to chapter 7 of Technical Manual TM11-1524.

All adjustments for this unit will be covered in Section VIII of this manual.

4. Azimuth and Elevation Velocity Servo Amplifiers

There are two identical velocity servo amplifiers employed in the scan mode of operation of the antenna. These servo amplifiers are located in

the upper left hand compartment of the console as viewed from the rear.

Referring to schematic figure 12 and block diagram figure 10 , it can be seen that the input of this unit is the a-c input signal which the operator selects with the azimuth or elevation speed control. This low amplitude a-c signal is fed through R2 of the amplifier to tube V1. Tube V2 serves as another stage of amplification with degenerative feedback to provide amplifier stability. The output of stage V2 is then fed to two 6L6 tubes, V3 and V4, which operate in push-pull. The plates of V3 and V4 feed the primary of transformer T1. Transformer T1 secondary is connected to the drive winding of the scan motor located in the motor drive unit. To provide a closed velocity scan loop to drive the antenna positioning servo, tachometer feedback is employed. This signal is developed when the scan motor turns. It is applied to resistor R1 in the velocity amplifier and is 180° out of phase with the velocity input signal with which it is summed.

It will be noted in figure 12 that resistor R5 is factory adjusted and should not be touched. The adjustment of Hum Balance Control R22 is covered in Section VIII.

The primary of transformer T2 is fused at the main fuse panel.

5. Motor Drive Unit

The schematic of this unit is shown in figure B . It will be noted that both the azimuth and elevation channel velocity servo drive motors and differential synchros are located in this unit, which is housed in the lower left compartment of the console.

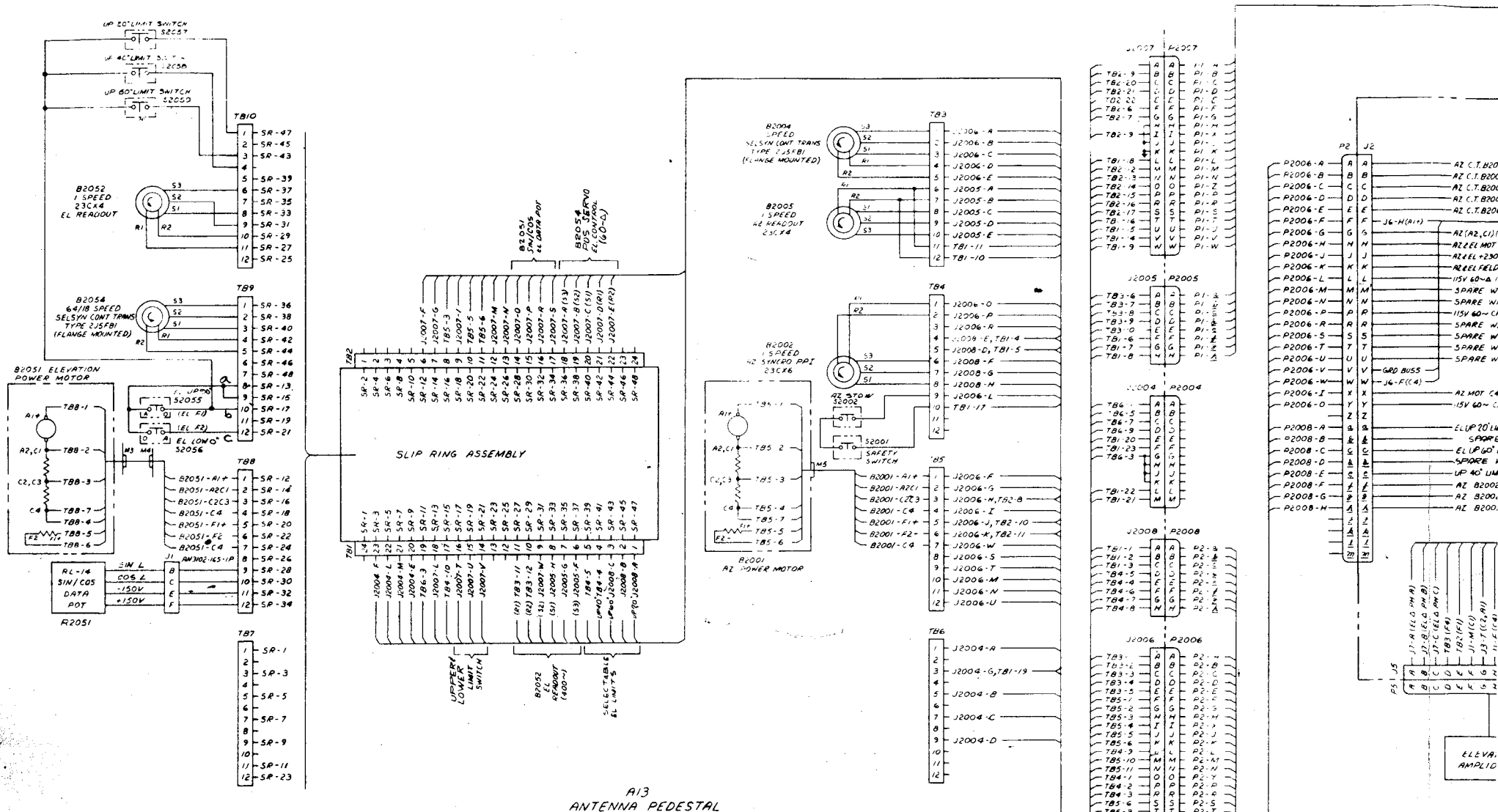
The operation of the motor drive is described in conjunction with the azimuth and elevation servo amplifiers. (See section V. D. 4.)

6. Antenna Position Indicators

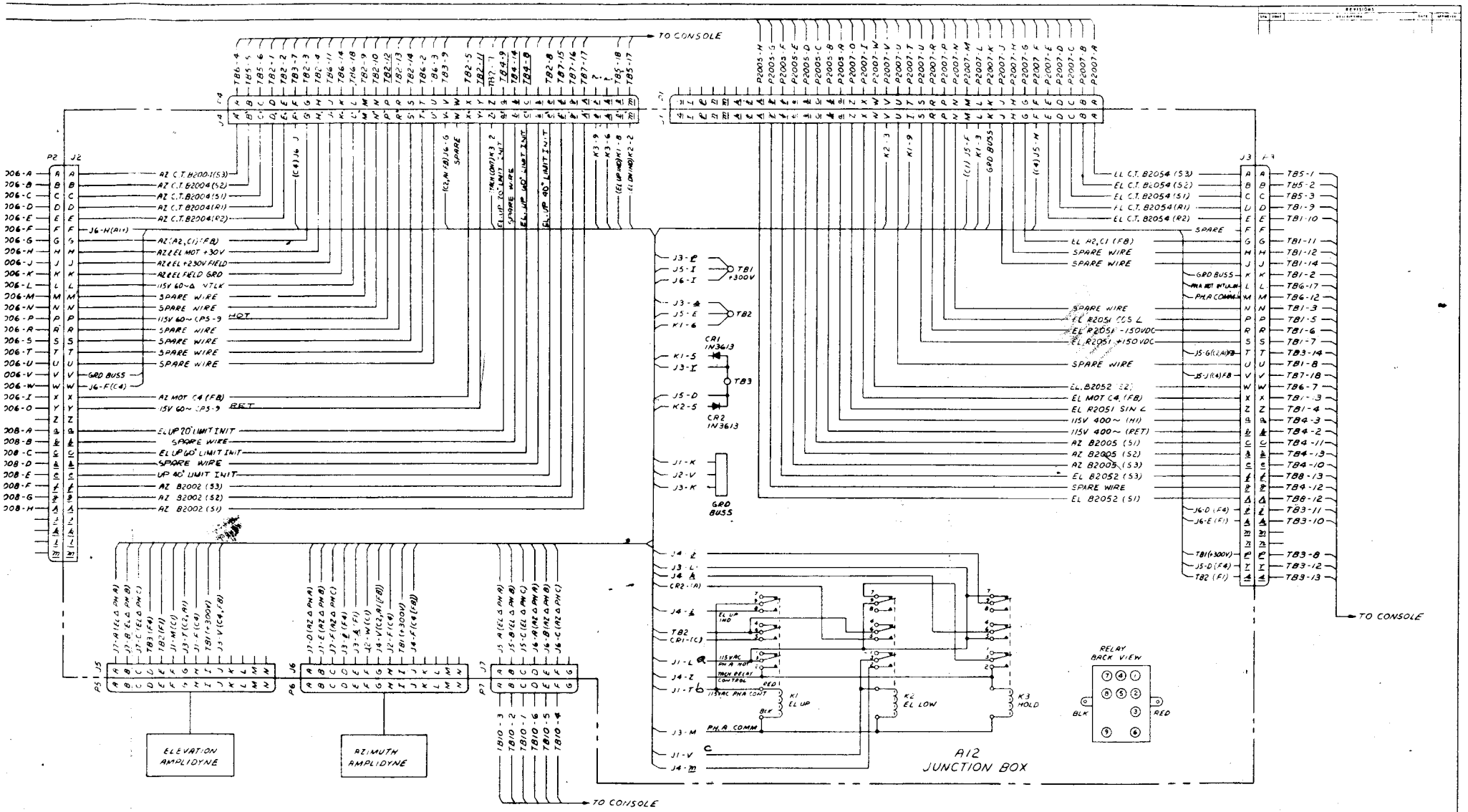
Readout of antenna position to an accuracy of 0.1% has been provided for both azimuth and elevation. The readout units are identical and a schematic is shown as figure 14.

As stated earlier in this section, when the main power circuit breaker is turned on, the +28 vdc power supply and the 400 cycle converter are energized. When this takes place, 115 vac, 400 cycle power is then applied to the rotors of the azimuth and elevation synchros in the pedestal. The stator signals of these

synchros are brought down to their respective readout units and drive control synchros. The rotor winding of synchro B2 drives a solid state servo amplifier which drives a d-c motor with tachometer feedback. When the motor turns, it drives the mechanical readout which then digitally indicates the antenna position.



A13
ANTENNA PEDESTAL



ITEM NO	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL OR NOTE	SPECIFICATION
QTY REQD					

LIST OF MATERIALS OR PARTS LIST

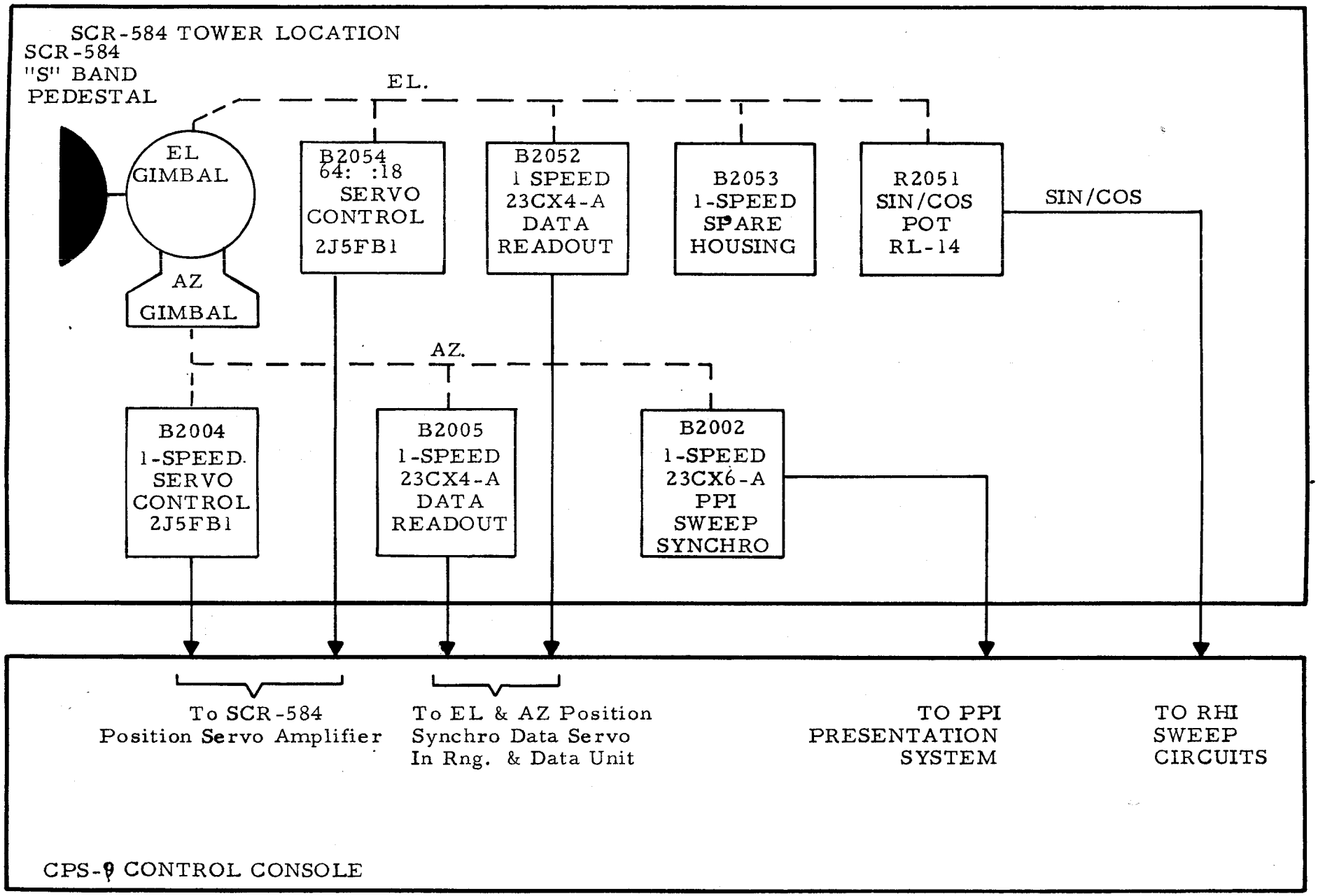
SIERRA Research Corporation

INTERCONNECTING WIRING DIAGRAM - S BAND MIT WEATHER RADAR SYSTEM ANTENNA PEDESTAL & RACK

SIZE	CODE IDENT NO	DWG NO
D	12113	J-6510-0068

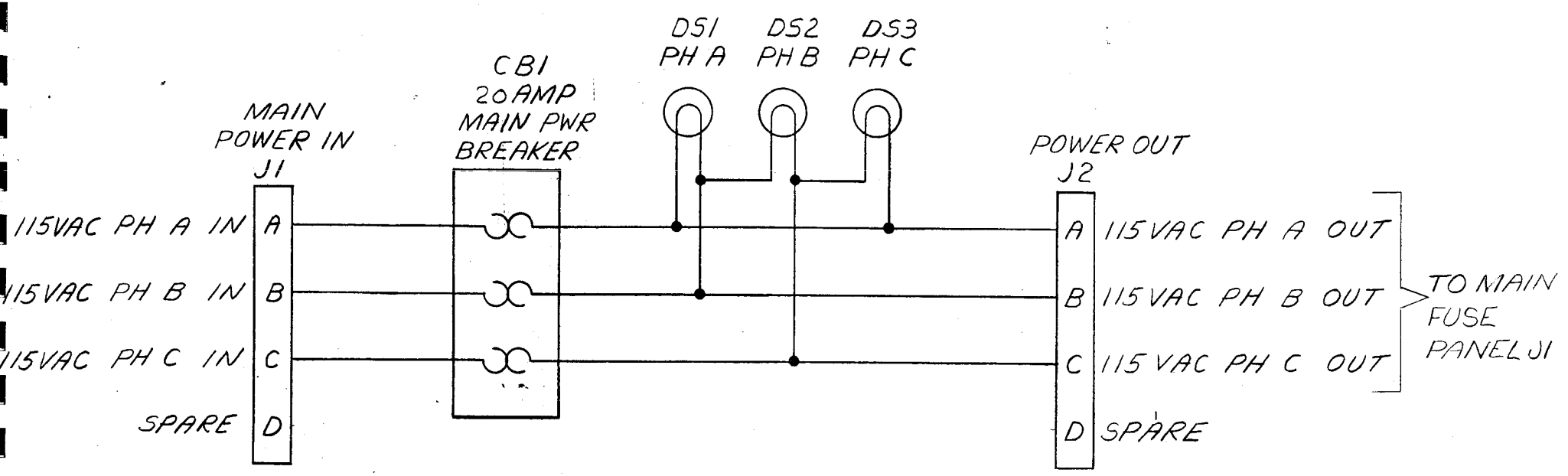
SCALE: NONE SHEET 2

FIG # 2



ANTENNA SYNCHRO SYSTEM

FIG. #4



N. Kozuta
26 NOV 1965

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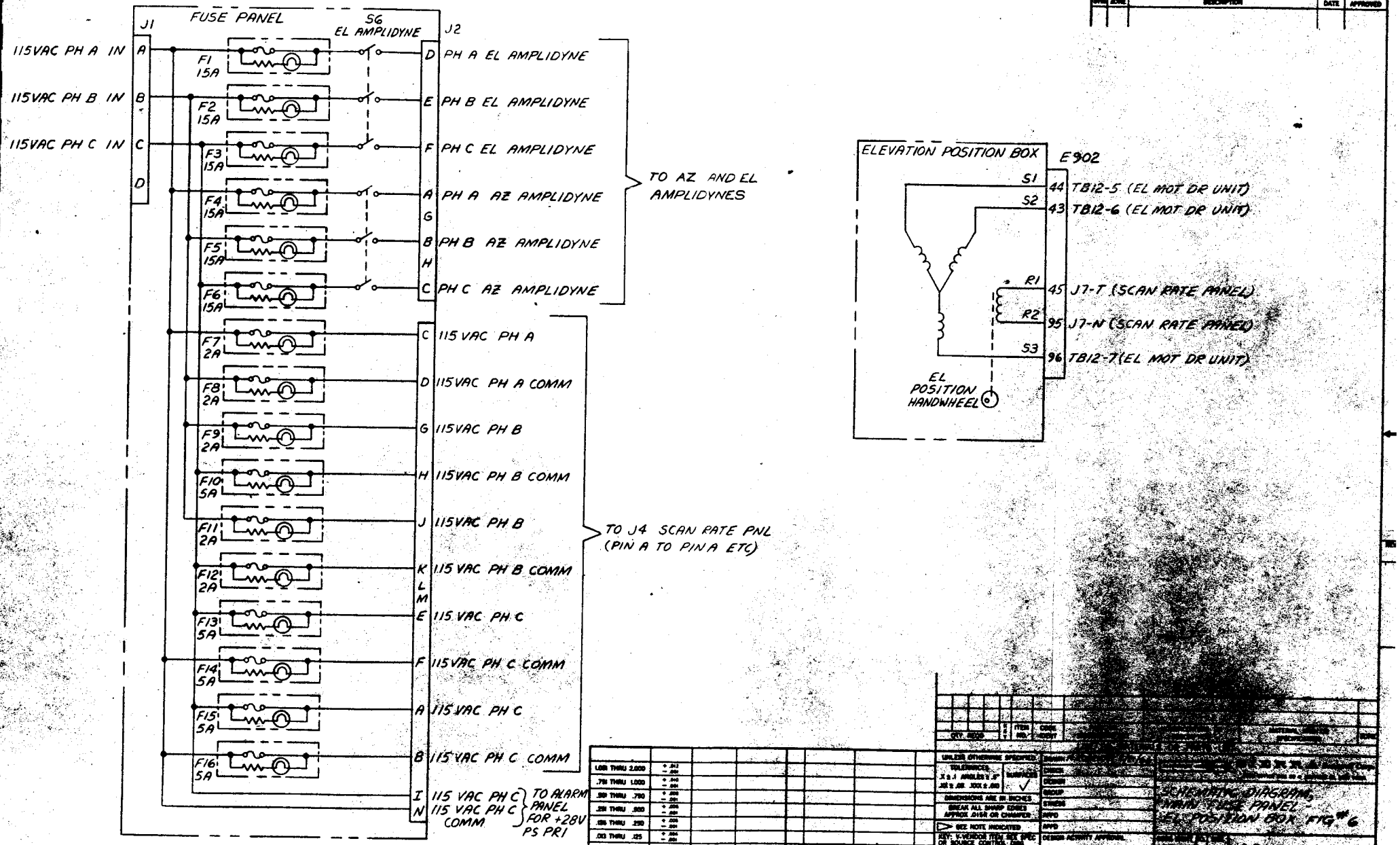
SCHEMATIC DIAGRAM,
MAIN POWER PANEL
(A1) FIG #5

CODE IDENT NO.	SIZE	
12115	B	6510-0055
SCALE NONE	CONTR NO.	SHEET 1 OF 1



REVISIONS				
QTY	ZONE	DESCRIPTION	DATE	APPROVED

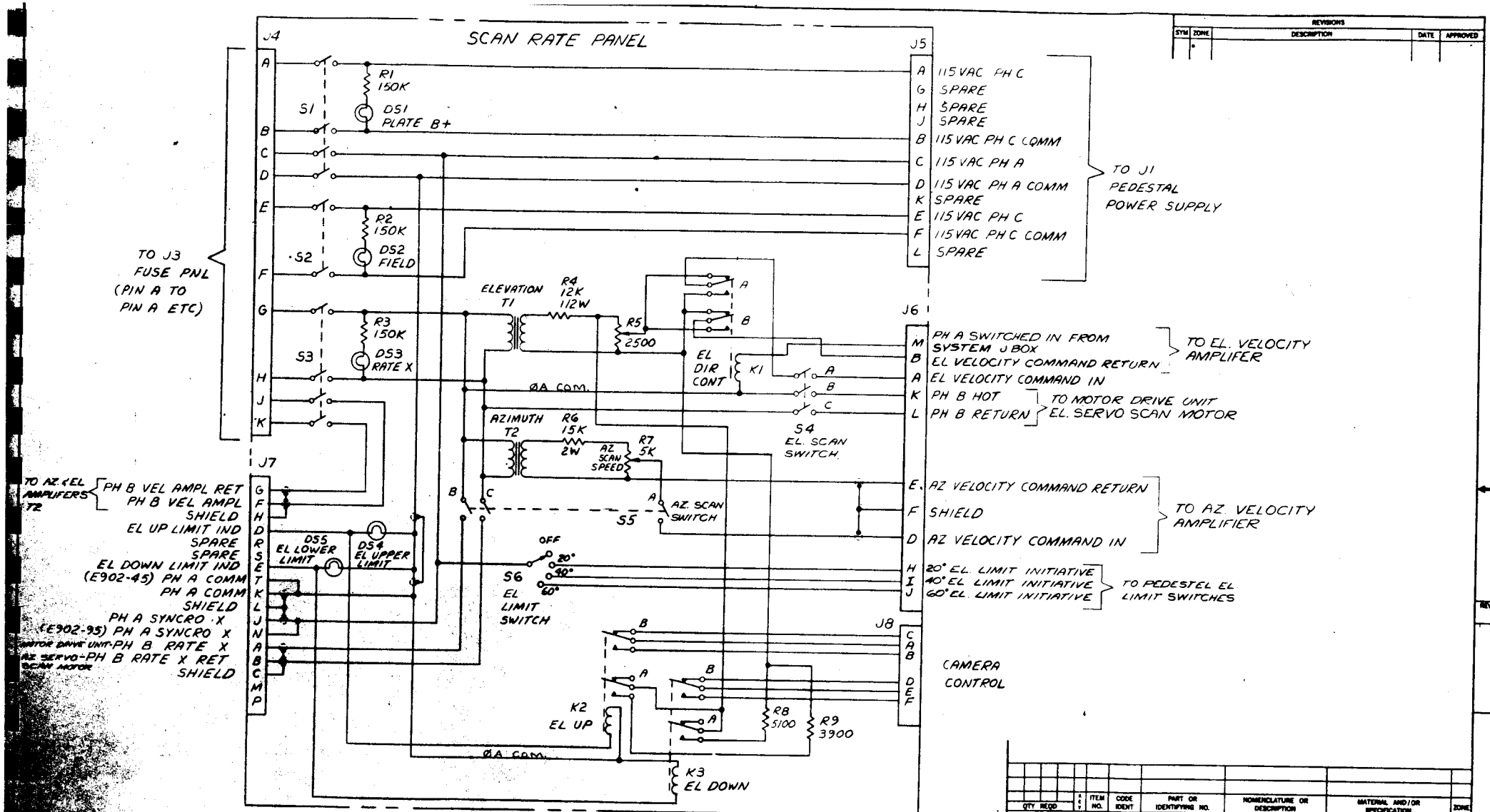
HOLE TOLERANCES		APPLICABLE SPECIFICATIONS		APPLICATION			
NOMINAL DIA	TOLERANCE	NUMBER	APPLICATION	DASH NO.	NEXT ASSY	USED ON	QTY NEED
.500 THRU 2.000	± .002 − .001						
.751 THRU 1.000	± .003 − .001						
.501 THRU .750	± .003 − .001						
.251 THRU .500	± .003 − .001						
.126 THRU .250	± .003 − .001						
.063 THRU .125	± .002 − .001						

UNLESS OTHERWISE SPECIFIED
TOLERANCES
X ± .1 ANGLES ± 2°
.XX ± .03 .XXX ± .010
DIMENSIONS ARE IN INCHES
BREAK ALL SHARP EDGES APPROX .010R OR CHAMFER
SURFACES ✓
SEE NOTE INDICATED
REV. V-VENDOR ITEM SEE SPEC OR SOURCE CONTROL DWG
FIRST LINCHES
SUPS
SUPSD BY

DESIGN
DRAWN
GROUP
ENGRG
APPD
APPD
DESIGN ACTIVITY APPROVAL
OTHER APPROVAL

SCHEMATIC DIAGRAM, MAIN FUSE PANEL - EL POSITION BOX FIG #6

SCALE	CODE IDENT	DWG NO.	SHEET
NONE	12115	D 6510-0056	1 OF 2



SYM	ZONE	REVISIONS DESCRIPTION	DATE	APPROVED
*				

QTY REQD	KEY	ITEM NO.	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL AND/OR SPECIFICATION	ZONE

LIST OF MATERIALS OR PARTS LIST

HOLE TOLERANCES								
NOMINAL DIA	TOLERANCE	NUMBER	APPLICATION	DASH NO.	NEXT ASSY	USED ON	QTY REQD
.000 THRU 2.000	+.003 −.001			APPLICABLE SPECIFICATIONS		APPLICATION	
.751 THRU 1.000	+.004 −.001						
.501 THRU .750	+.003 −.002						
.251 THRU .500	+.004 −.001						
.126 THRU .250	+.003 −.002						
.013 THRU .125	+.004 −.001						

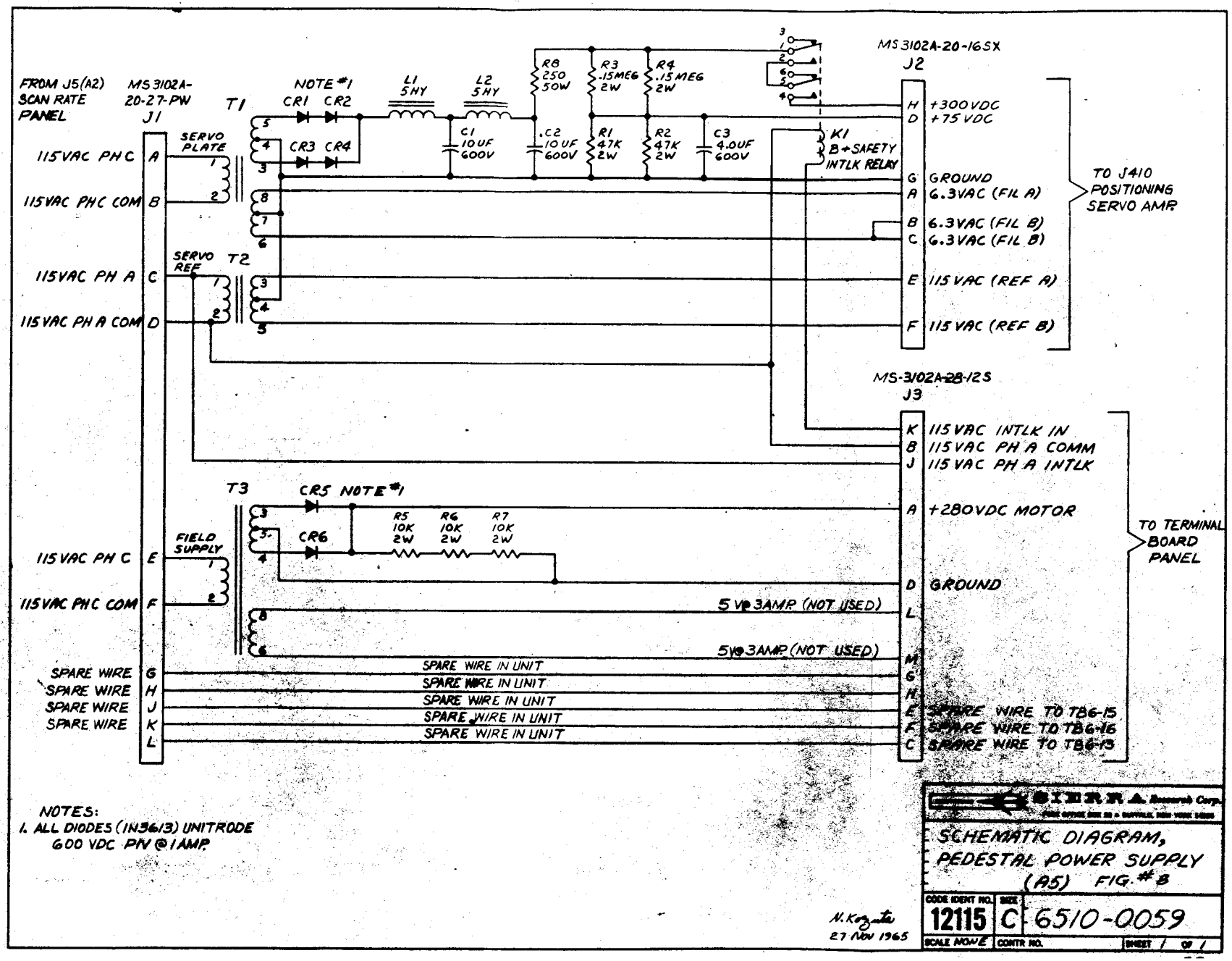
UNLESS OTHERWISE SPECIFIED	DRAWN N. L'OSZUTA 2/22/66
TOLERANCES .X ± .1 ANGLES ± .5° .XX ± .03 .XXX ± .010	CHECK
SURFACES ✓	DESIGN
DIMENSIONS ARE IN INCHES	GROUP
BREAK ALL SHARP EDGES APPROX .015R OR CHAMFER	STRESS
SEE NOTE INDICATED	APPD
KEY: V-VENDOR ITEM SEE SPEC OR SOURCE CONTROL DWG F-FEET I-INCHES	APPD
SUPS	DESIGN ACTIVITY APPROVAL
SUPSD BY	OTHER APPROVAL

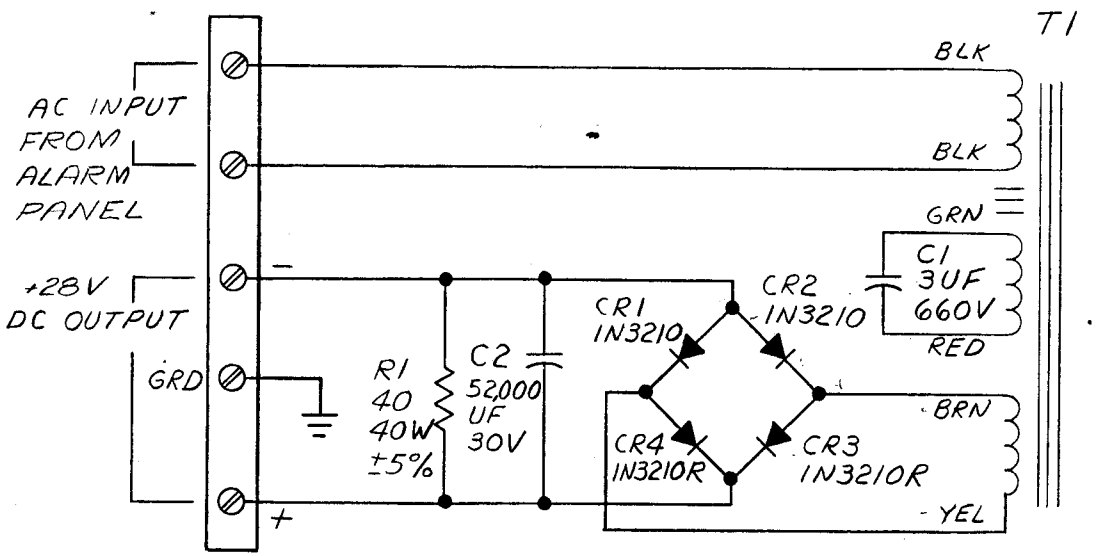
SIERRA Research Corp.

SCHEMATIC DIAGRAM, SCAN RATE PANEL FIG # 7

CODE IDENT NO.	SIZE	
12115	D	6510-0056

SCALE ~ CONT NO SHEET 2 OF


FROM J5(A2) SCAN RATE PANEL
MS3102A-20-27-PW J1
T1
NOTE #1
CR1 CR2 CR3 CR4
L1 5HY
L2 5HY
C1 10UF 600V
C2 10UF 600V
R8 250 50W
R3 .15MEG 2W
R4 .15MEG 2W
R1 47K 2W
R2 47K 2W
C3 4.0UF 600V
K1 B+SAFETY INTLK RELAY
MS3102A-20-16SX J2
H +300VDC
D +75VDC
G GROUND
A 6.3VAC (FIL A)
B 6.3VAC (FIL B)
C 6.3VAC (FIL B)
E 115VAC (REF A)
F 115VAC (REF B)
TO J410 POSITIONING SERVO AMP
115VAC PH C A
115VAC PH C COM B
SERVO PLATE
115VAC PH A C
115VAC PH A COM D
SERVO REF
T2
MS-3102A-28-12S J3
K 115VAC INTLK IN
B 115VAC PH A COMM
J 115VAC PH A INTLK
T3
CR5 NOTE #1
CR6
R5 10K 2W
R6 10K 2W
R7 10K 2W
A +280VDC MOTOR
D GROUND
L 5V@3AMP (NOT USED)
M 5V@3AMP (NOT USED)
FIELD SUPPLY
115VAC PH C E
115VAC PH C COM F
SPARE WIRE G
SPARE WIRE H
SPARE WIRE J
SPARE WIRE K
SPARE WIRE L
SPARE WIRE IN UNIT
SPARE WIRE IN UNIT
SPARE WIRE IN UNIT
SPARE WIRE IN UNIT
SPARE WIRE IN UNIT
G SPARE WIRE TO TB6-15
H SPARE WIRE TO TB6-16
E SPARE WIRE TO TB6-13
TO TERMINAL BOARD PANEL
NOTES:
1. ALL DIODES (IN3613) UNITRODE 600 VDC PIV @ 1AMP
N. Kozuta 27 NOV 1965
SCHEMATIC DIAGRAM, PEDESTAL POWER SUPPLY (A5) FIG. # 8
CODE IDENT NO. 12115
SIZE C
6510-0059
SCALE NONE
CONTR NO.
SHEET 1 OF 1



N. Kozuta
11/26/65

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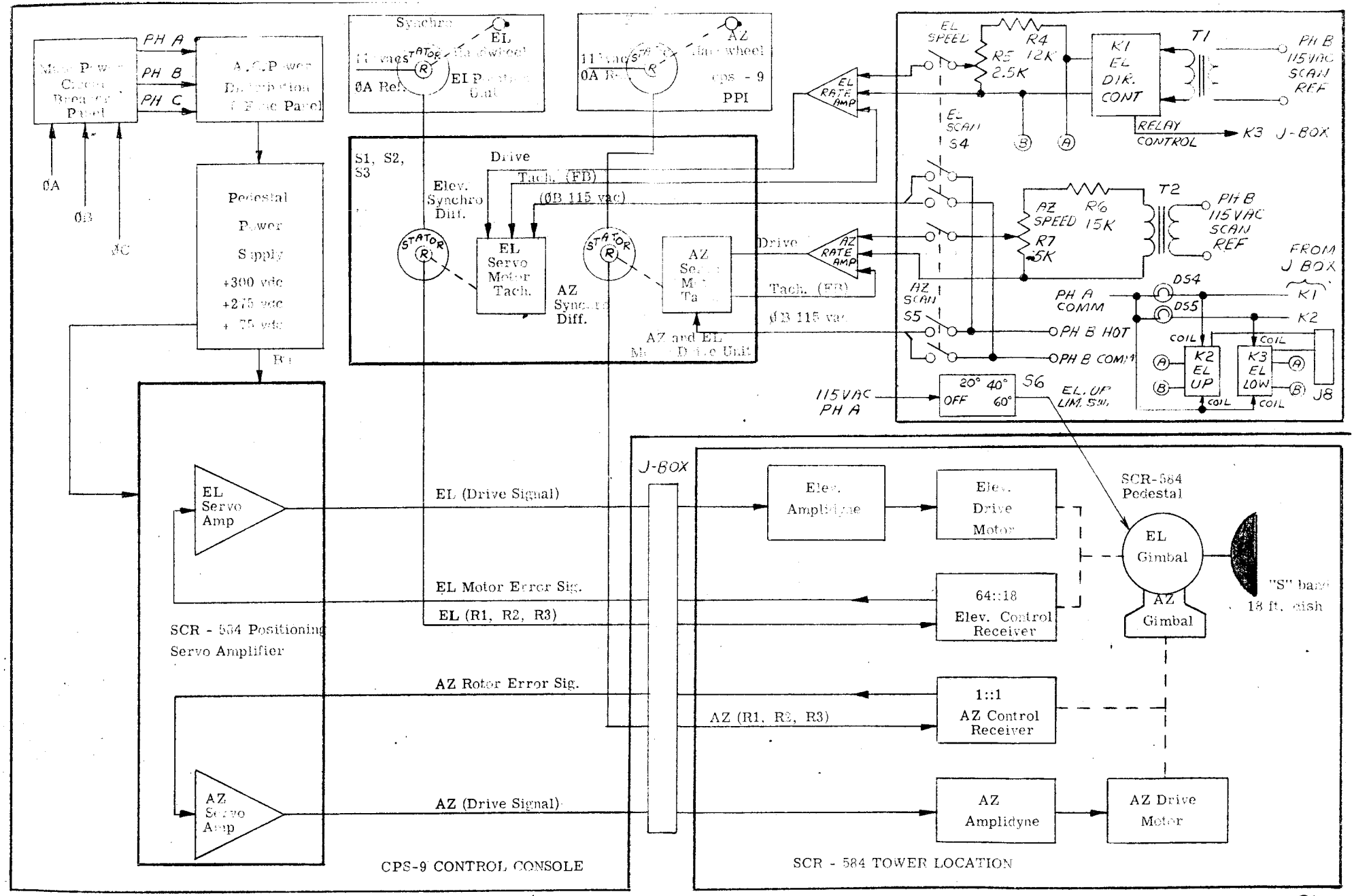
SCHEMATIC DIAGRAM,
28VDC POWER SUPPLY
(A8) FIG #9

CODE IDENT NO.	SIZE	
12115	B	6510-0065
SCALE NONE	CONTR NO.	SHEET 1 OF 1


PH A
PH B
PH C
ØA
ØB
ØC
Pedestal
Power
Supply
+300 vdc
+275 vdc
+ 75 vdc
EL
Synchro
AZ
Synchro
PPI
S1, S2,
S3
Drive
Tach. (FB)
(ØB 115 vac)
Elev.
Synchro
Diff.
EL
Servo
Motor
Tach.
AZ
Synchro
Diff.
AZ and EL
Drive Unit
EL
RATE
AMP
AZ
RATE
AMP
EL
SPEED
R4
R5 12K
2.5K
K1
EL
DIR.
CONT
T1
PH B
115 VAC
SCAN
REF
EL
SCAN
S4
RELAY
CONTROL
K3 J-BOX
AZ
SPEED
R6 15K
R7 5K
T2
PH B
115 VAC
SCAN
REF
FROM
J BOX
AZ
SCAN
S5
PH A
COMM
PH B HOT
PH B COMM
DS4
DS5
K1
K2
K3
COIL
K2
EL
UP
K3
EL
LOW
J8
115 VAC
PH A
20° 40°
OFF 60°
S6
EL. UP
LIM. SW.
J-BOX
EL
Servo
Amp
AZ
Servo
Amp
SCR - 584 Positioning
Servo Amplifier
EL (Drive Signal)
EL Motor Error Sig.
EL (R1, R2, R3)
AZ Rotor Error Sig.
AZ (R1, R2, R3)
AZ (Drive Signal)
CPS-9 CONTROL CONSOLE
Elev.
Amplidyne
Elev.
Drive
Motor
64::18
Elev. Control
Receiver
1::1
AZ Control
Receiver
AZ
Amplidyne
AZ Drive
Motor
SCR-584
Pedestal
EL
Gimbal
AZ
Gimbal
"S" band
18 ft. dish
SCR - 584 TOWER LOCATION

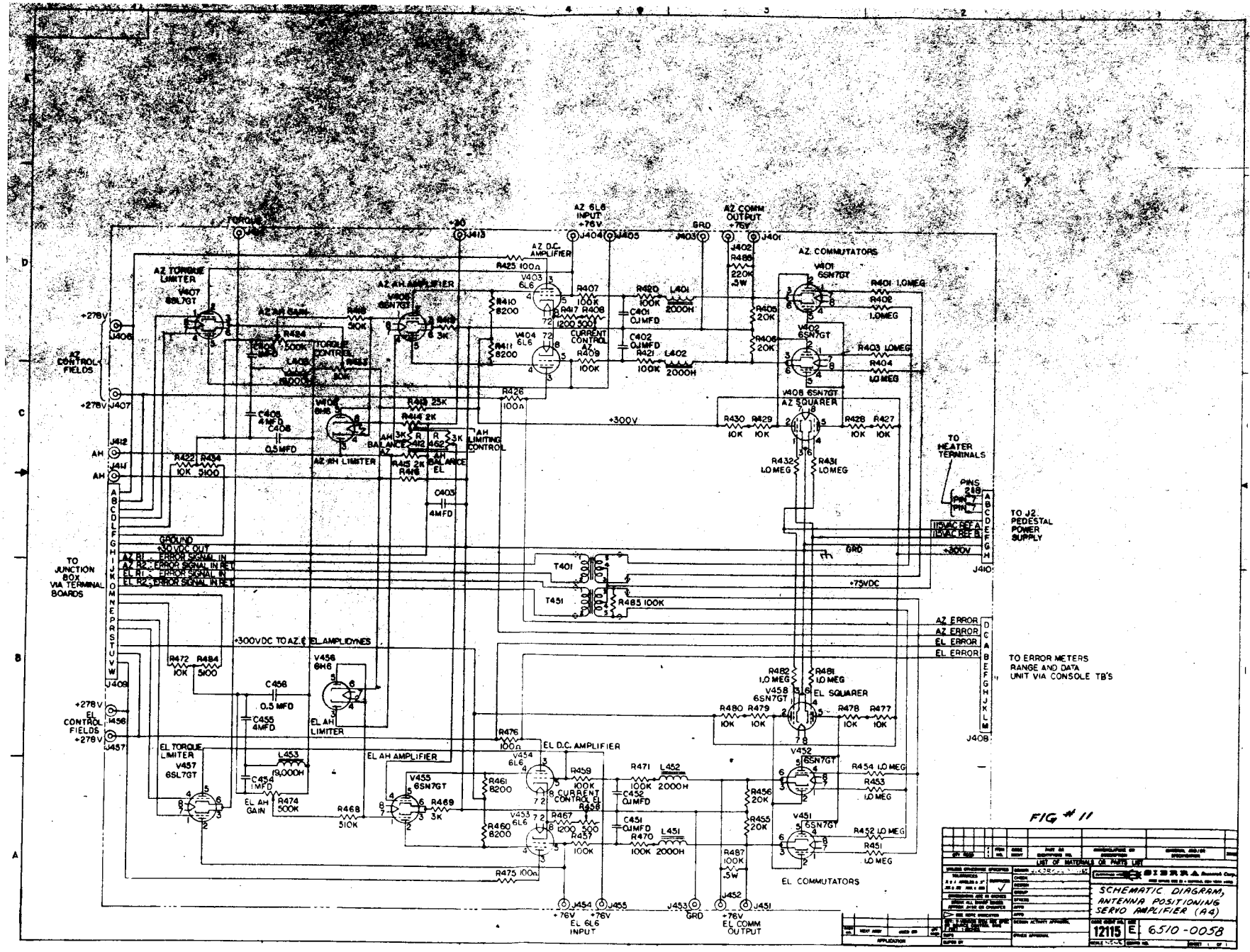


FIG # 11

SCHEMATIC DIAGRAM, ANTENNA POSITIONING SERVO AMPLIFIER (A4)	
SIZE 12115	E 6510-0058

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED

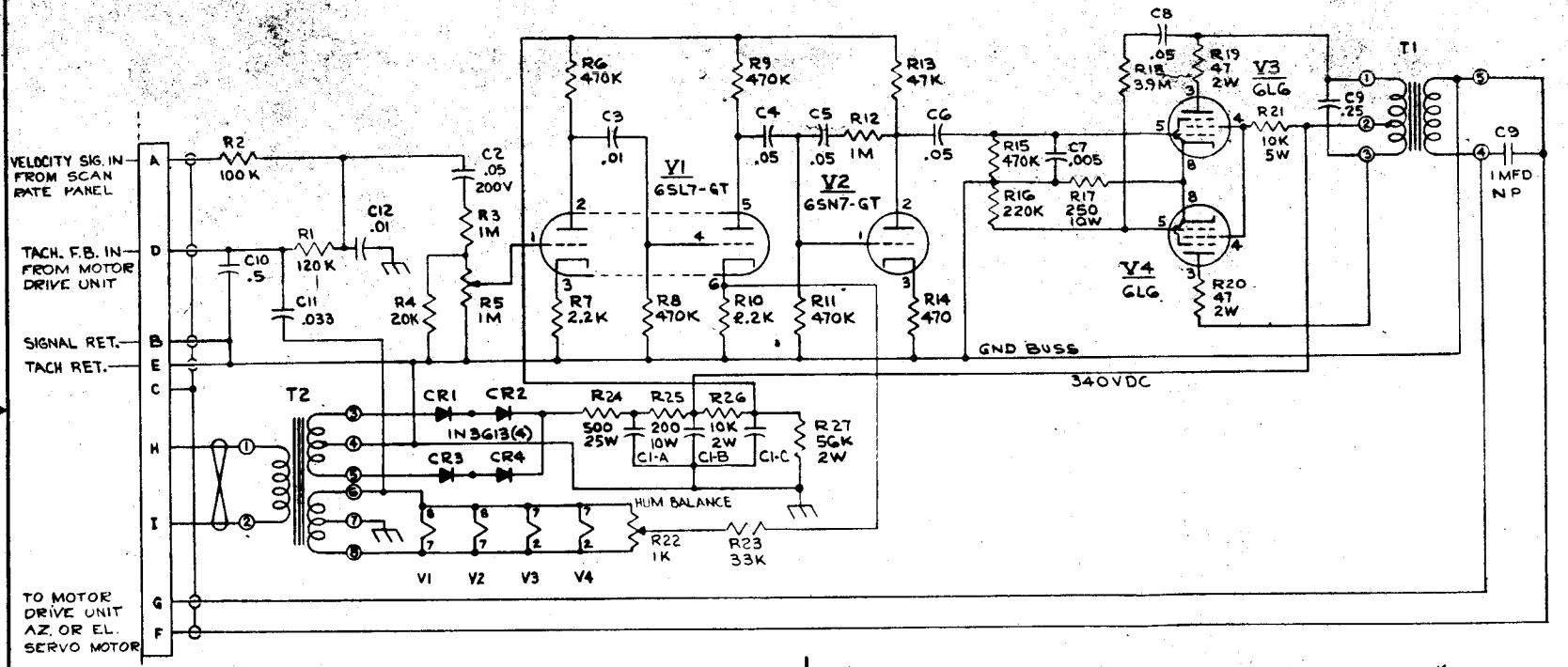


FIG # 12

3. CAPACITOR C1 IS 20MFD, 475V ON TERMINALS A, B, C.
2. ALL CAPACITORS 600VDC EXCEPT C1 AND C2
1. ALL RESISTORS 1W EXCEPT WHERE NOTED.

NOTES:

QTY REQD	KEY	ITEM NO.	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL AND/OR SPECIFICATION	ZONE

LIST OF MATERIALS OR PARTS LIST

NOMINAL DIA	TOLERANCE
1.001 THRU 2.000	+.012 −.001
.751 THRU 1.000	+.010 −.001
.501 THRU .750	+.008 −.001
.251 THRU .500	+.006 −.001
.126 THRU .250	+.005 −.001
.013 THRU .125	+.004 −.001

HOLE TOLERANCES

NUMBER	APPLICATION

APPLICABLE SPECIFICATIONS

DASH NO.	NEXT ASSY	USED ON	QTY REQD

APPLICATION

UNLESS OTHERWISE SPECIFIED	DRAWN J. KORKUC 11 NOV 65
TOLERANCES .X ± .1 ANGLES ± .5° .XX ± .03 .XXX ± .010	SURFACES ✓
DIMENSIONS ARE IN INCHES	CHECK
BREAK ALL SHARP EDGES APPROX .015R OR CHAMFER	DESIGN
▷ SEE NOTE INDICATED	GROUP
KEY: V-VENDOR ITEM SEE SPEC OR SOURCE CONTROL DWG F-FEET I-INCHES	STRESS
SUPS	APPD
SUPSD BY	APPD
	DESIGN ACTIVITY APPROVAL
	OTHER APPROVAL

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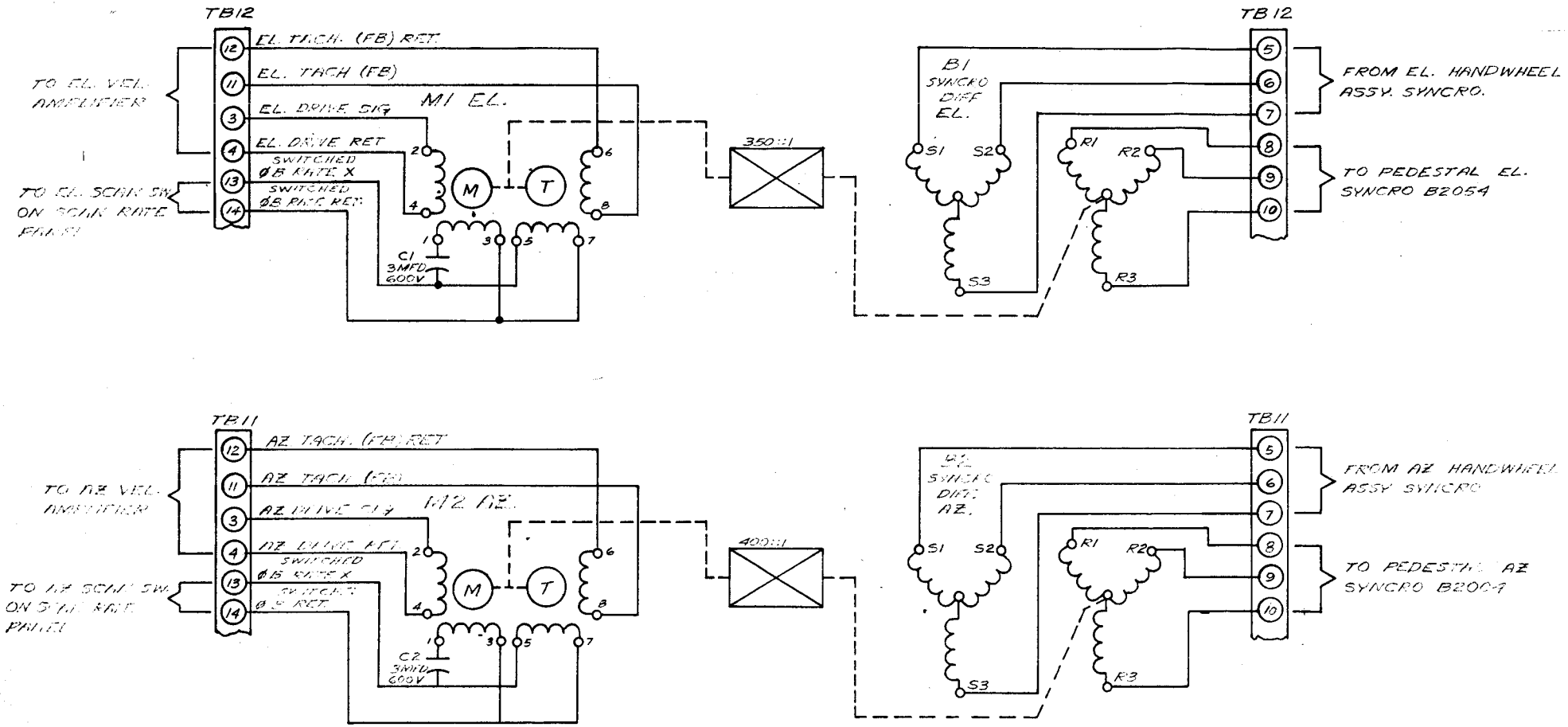
SCHEMATIC DIAGRAM,
AZIMUTH & ELEVATION VELOCITY AMPLIFIER
(AZIMUTH A9) (ELEVATION A10)

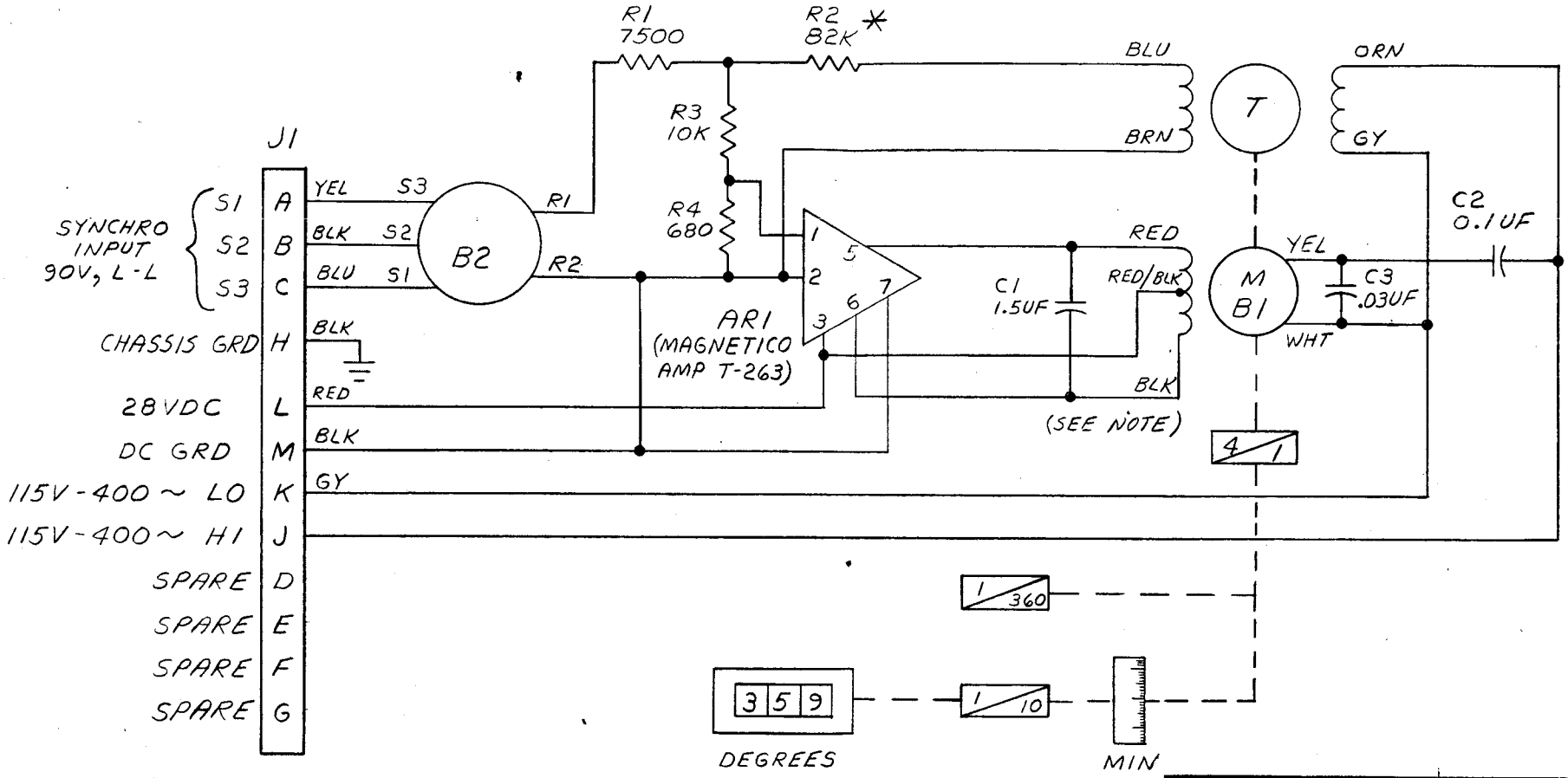
CODE IDENT NO.	SIZE	
12115	C	6510-0066

SCALE	CONTR NO.	SHEET
NONE		1 OF 1



MOTOR DRIVE UNIT

FIG. 13

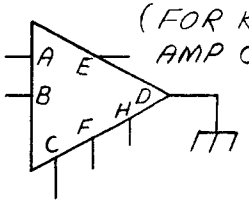


NOTE:

1. IF MOTOR HAS A GRN LEAD WIRE TO PIN 3 OF AR1

* SELECT FEEDBACK RESISTOR IN TEST NOM. 82K, 1/2W, ±5%

AR1 (FOR KEARFOTT AMP C703148009)



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SCHEMATIC DIAGRAM, ELEVATION - AZIMUTH READOUT FIG. #14

CODE IDENT NO.	SIZE	
12115	B	6510-0060
SCALE NONE	CONTR NO.	SHEET 1 OF 1

SECTION VI
RANGE DATA AND READOUT UNIT THEORY OF OPERATION

A. GENERAL DESCRIPTION

The range data and readout unit consists of all the necessary electronic circuitry and power supplies for the 0 to 400 KM variable range mark generator. Also included in the unit is the necessary trigger circuitry for the indicator displays, as well as the azimuth and elevation servo error meters and readouts.

To facilitate coaxial cable wiring in the console, the range data and readout unit also serves as a junction point for all trigger signals.

It will be noted that a fixed range mark selector switch is provided on the front panel of the unit. Operation of this switch will provide fixed range marks only when the desired range mark signals are applied to the correct corresponding coaxial fitting located at the bottom rear of the console.

Figure 15 is the interconnecting wiring diagram of the range data and readout unit. It will be noted in this drawing that reference is made to the individual circuit boards and components within the unit.

As shown in figure 15 the Phantastron delay circuits are comprised of tubes V2, V3, V4 and trigger amplifier V1. The B+ voltages for these stages are obtained by utilizing the existing +320 vdc supply of the CPS-9, and then further regulating to the required +255 vdc and +150 vdc by use of regulator tubes V5 and V6.

B. 0 TO 400 KM VARIABLE RANGE MARK GENERATOR

This unit produces the variable range mark that is fed to all indicators. Figure 16 shows the range data unit in block diagram from with corresponding waveforms shown in figure 17 .

Trigger No. 1 and Trigger No. 2 are 198.6 μsec. apart. The reason for this particular separation will be explained further in the test. Trigger No. 1 fires the variable Phantastron, the duration of which is controlled by variable resistor R3. Figure 16 shows the Phantastron in its minimum setting of 32 μsec. The end of the Phantastron sweep creates a pulse that is fed to the trigger amplifier and to the 166.66 μsec. delay multivibrator. The

shaper amplifier has a pulse output of approximately 1 μsec. width and 30 volts amplitude. This pulse is then available as a trigger to the R indicator. The output of the 166.66 μsec. one shot multivibrator is fed into a shaper amplifier which has a pulse output of approximately 0.25 μsec. width and 30 volts amplitude. This pulse is used as the variable range mark.

Examination of figure 16 shows that developing the range mark 166.66 μsec. after the R indicator trigger places it at the center of the 50 KM (333.33 μsec.) sweep. Trigger No. 2, which starts the PPI and RHI indicator sweeps, must occur at 32 + 166.6 = 198.6 μsec. after Trigger No. 1 in order to have the variable range mark present in correct time sequence. As the variable range mark crank is turned from its minimum setting, the variable Phantastron delay increases in duration and the R indicator trigger occurs later in time so that a different 50 KM segment is displayed on the R indicator. The variable range mark, which is always at the center, can be made to coincide with any desired target, with the range of the target displayed on a calibrated counter. Coincidence between the variable range mark and a target on the PPI may be similarly accomplished with range information available on the same calibrated counter.

Switching the R indicator to the 10 KM position places a 133.33 μsec. delay on incoming Trigger No. 1 and changes the 166.66 μsec. delay to a 33.33 μsec. delay. (Figure 16.)

A study of figure 17 will show how the new time delays cause the variable range mark to maintain its position at the center of the R indicator. Note that at zero range the variable range marks still occurs 198.6 μsec. after Trigger No. 1.

Trigger No. 2 is fed through the blocking oscillator so that a pulse of proper level is available to trigger the PPI and RHI sweep circuits.

C. LOW-VOLTAGE POWER SUPPLIES

1. A low-voltage power supply provides all of the d-c voltages required for the transistor circuitry. It contains separate sources of +22 vdc, +12 vdc, +6 vdc, -12 vdc, and -22 vdc. Regulation of the +22 vdc, +6 vdc, -12 vdc, and -22 vdc power supplies is accomplished by series regulators. Regulation of the +12 vdc power supply is accomplished by a shunt regulator. The +22 vdc source is used as the master reference supply, with the other four supplies (+12 vdc,

+6 vdc, -12 vdc, and -22 vdc) referenced to it. Four of the d-c power supplies (+22 vdc, +6 vdc, -12 vdc, and -22 vdc) employ a fuse in the collector circuit of their respective regulator transistors as overload protection.

The rectifiers, bias network, and filter circuitry are mounted on rectifier-filter printed circuit board 1A6A1. Nearly all of the regulator circuitry is mounted on voltage regulator printed circuit board A6A2. The series regulator transistors and power transformer T5 are mounted on the chassis (figure 10) which also serves as a heat sink for the series regulator power transistors. Refer to figures 19 and 20.

2. +22 VDC Supply

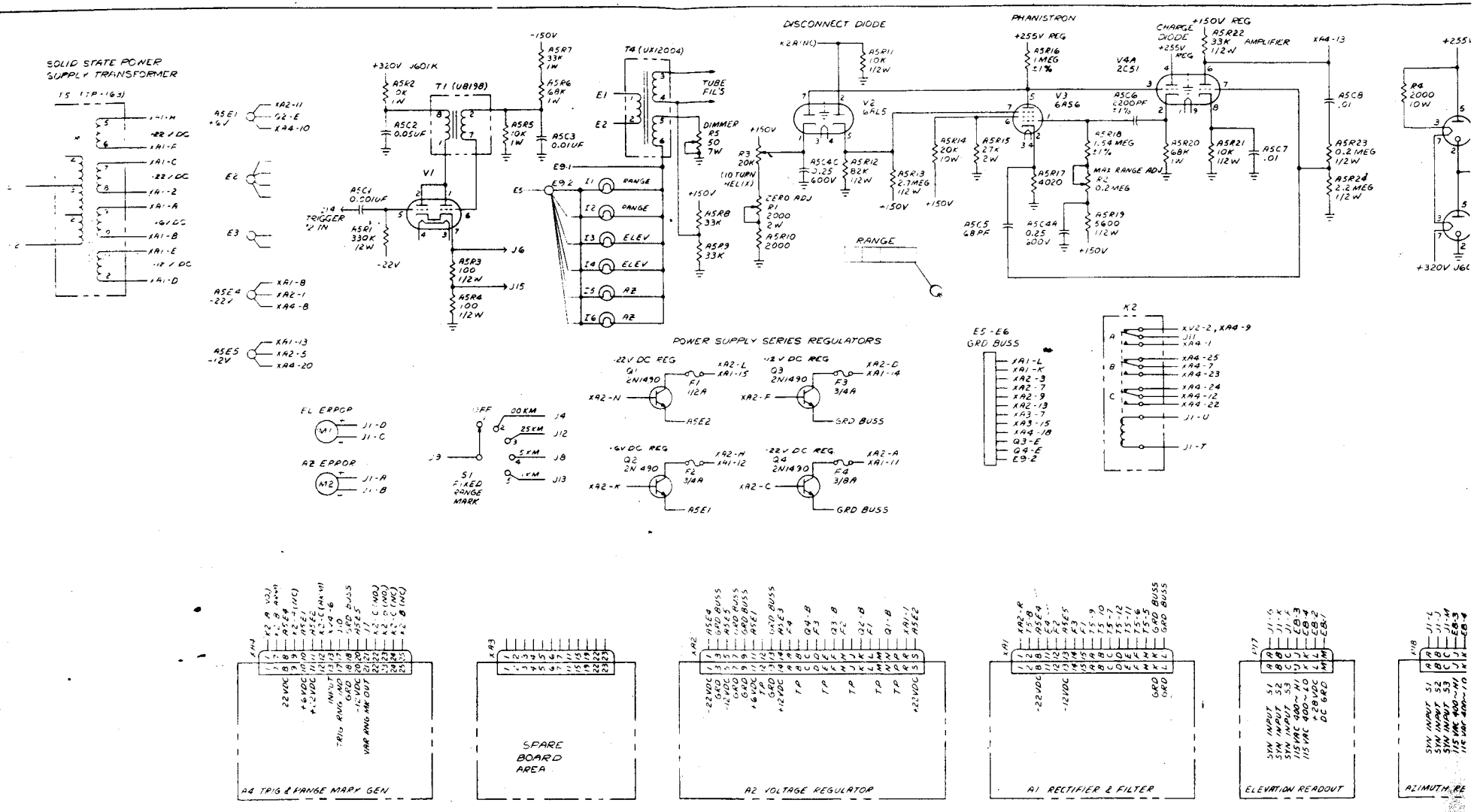
The secondary transformer T5 applies power to the bridge rectifier composed of diodes A1CR1, A1CR2, A1CR3, and A1CR4. Resistor A1R1 and capacitors A1C3 and A1C4 form a pi-network filter. The regulator is a series-type regulator utilizing emitter-follower transistor Q1 as the series element. The regulator employs fuse F1, in the collector circuit of transistor Q1, as overload protection. Transistor A2Q1 is the power amplifier required to provide the relatively high output current from the +22 vdc supply. Zener diode A2CR2 provides a constant voltage at the base of differential amplifier transistor A2Q2. Collector voltage for this stage is provided through resistor A2R2 from the voltage doubler bias circuitry composed of diodes A1CR5 and A1CR6, and capacitors A1C1 and A1C2. This voltage is stabilized by Zener diode regulator A2CR1 and resistor A2R1. Resistors A2R6 and A2R7 form a voltage divider which sets the bias level of differential amplifier A2Q3. Any variation in the +22 volt supply, due to line voltage or load current variation, causes the base voltage of transistor A2Q3 to change. This variation causes the current in resistor A2Q2 also change. The collector voltage of transistor A2Q2 will change due to the variation of the base voltage. This error voltage is amplified by transistor A2Q1 and directly coupled to the base of series regulator transistor Q1. This voltage variation causes the voltage output of the regulator to return to the correct value by changing the impedance, and thus the voltage drop, across series regulator transistor Q1. Capacitors A2C6 and A2C1 are used to stabilize the regulating loop against oscillation.

3. +12 VDC Supply

The +12 vdc supply is shunt-regulated, and referenced to the +22 vdc and +6 vdc supplies. The divider network of resistors A2R8 and A2R9, plus the diode drop of the base-to-emitter function of transistor A2Q4, sets the output voltage at +12 volts. Emitter resistor A2R10 is in series with the load. Therefore, if the current flow through resistor A2R10 remains constant, the output voltage remains constant. Resistor A2R23 forms the collector load for transistor A2Q4. Any load variations of the +12 volt supply are reflected as changes in the collector voltage of transistor A2Q4. These variations control the current flow through parallel transistors A2Q5 and A2Q6. If the load current decreases, these two transistors conduct more current, keeping the current flow through resistor A2R10 constant. If the load current increases, the transistors conduct less current, again keeping the current flow through resistor A2R10 constant. Diode A2CR3 is used to prevent the two parallel transistor stages from becoming reverse-biased. Resistor A2R22 is used in the +6 vdc supply to ensure a foward current in the +6 vdc regulator in case the external load is removed.

4. +6 VDC, -12 VDC, and -22 VDC Supplies

Regulation of the +6 vdc, -12 vdc, and -22 vdc regulators is identical to the operation of the +22 vdc regulator except that the differential amplifier collector voltage is derived from the +22 vdc supply. Thus, a failure of the +22 vdc regulator will cause malfunctioning of the other regulators.


SOLID STATE POWER SUPPLY TRANSFORMER
T5 (TP-163)
+320V J601K
T1 (UB198)
T4 (UX12004)
TUBE FIL'S
DIMMER R5 50 7W
-150V
DISCONNECT DIODE
PHANISTRON
+255V REG
+150V REG
CHARGE DIODE
AMPLIFIER
V1
V2 6AL5
V3 6AS6
V4A 2C51
RANGE
ZERO ADJ P1 2000 2W
MAS RANGE ADJ R2 0.2 MEG
TRIGGER
-22V
+150V
POWER SUPPLY SERIES REGULATORS
-22V DC REG Q1 2N1490
-12V DC REG Q3 2N1490
-6V DC REG Q2 2N 490
-22V DC REG Q4 2N1490
GRD BUSS
E5-E6 GRD BUSS
EL EPPOR
AZ EPPOR
OFF
100KM
25KM
5KM
1KM
FIXED RANGE MARK
S1
SPARE BOARD AREA
A4 TRIG & RANGE MARK GEN
A2 VOLTAGE REGULATOR
A1 RECTIFIER & FILTER
ELEVATION READOUT
AZIMUTH RE

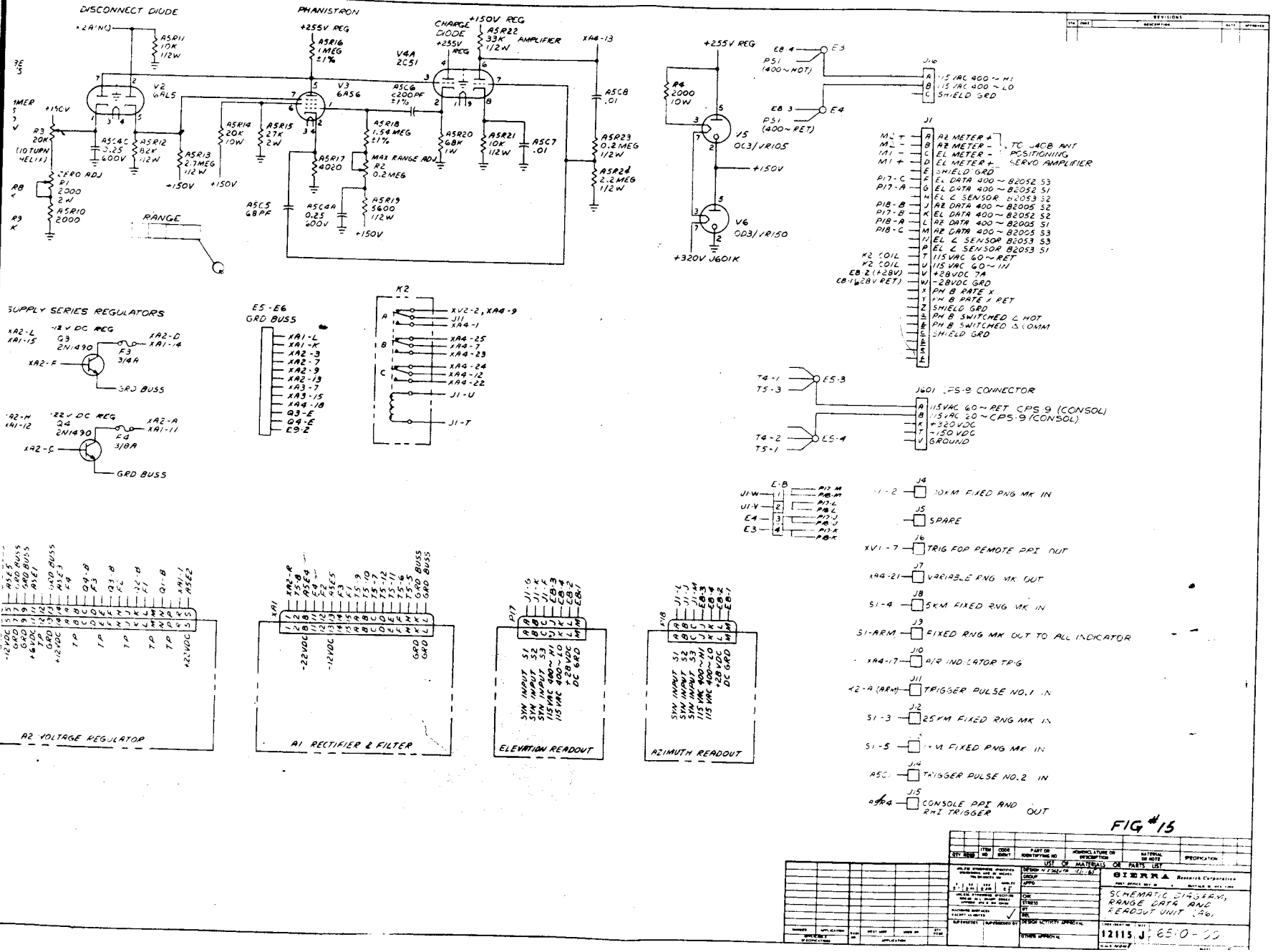


FIG #15

QTY REQD	ITEM NO	CODE IDENT	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL OR NOTE	SPECIFICATION

LIST OF MATERIALS OR PARTS LIST

SIERRA Research Corporation

SCHEMATIC DIAGRAM, RANGE DATA AND READOUT UNIT (A6)

12115, J; 65-0-53

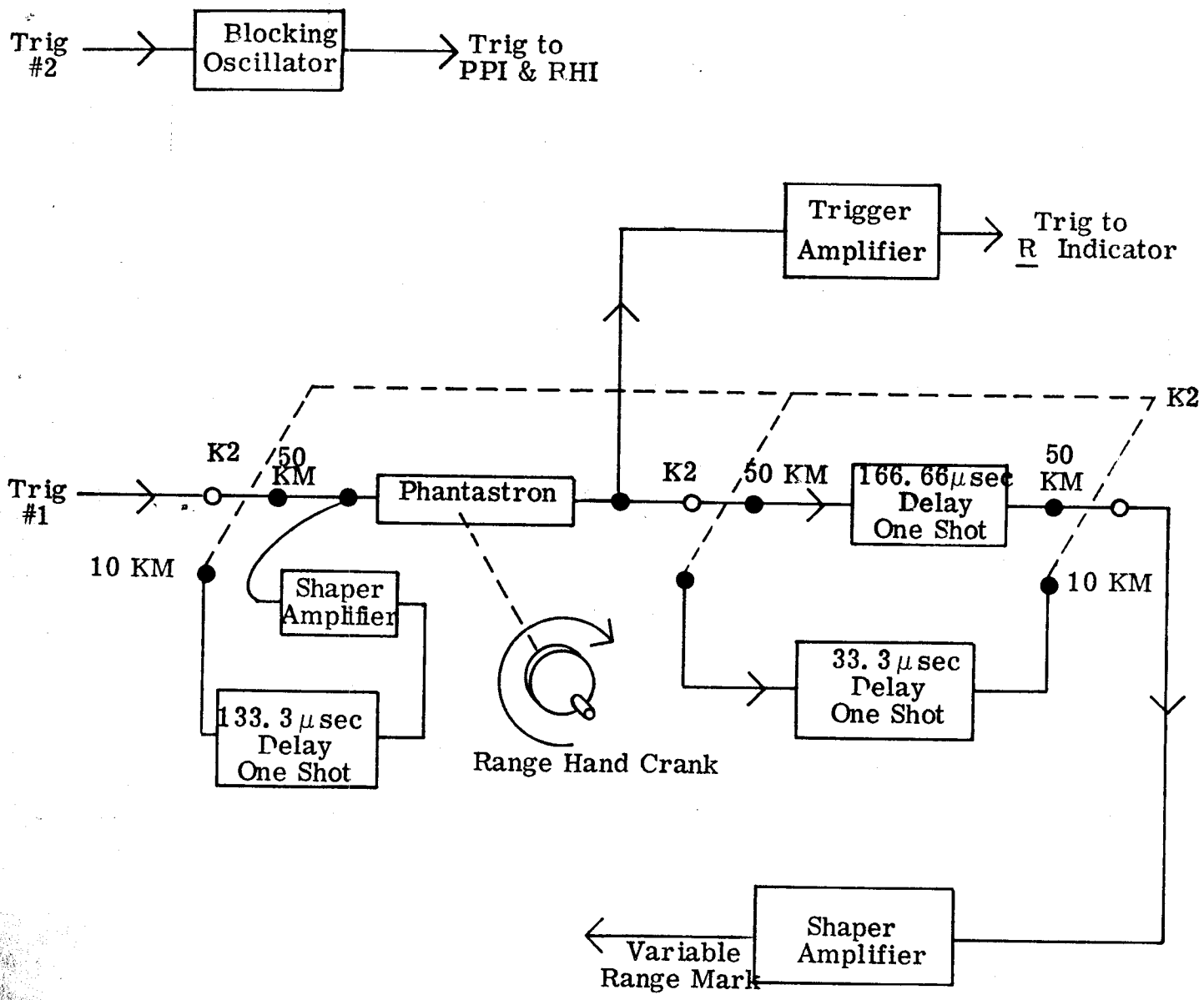
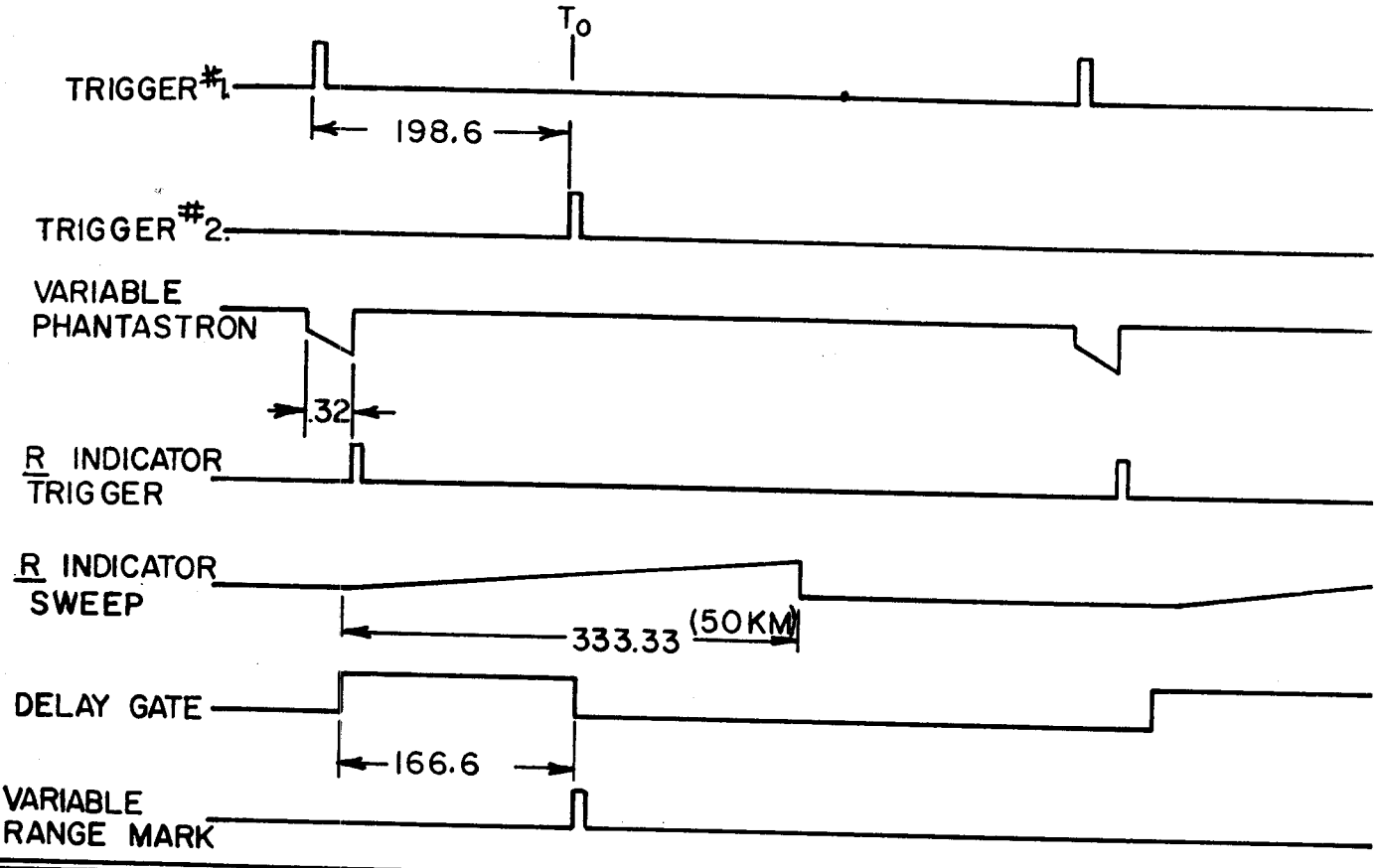


Figure #16. Simplified Block Diagram-Trigger & Range Mark Generator.



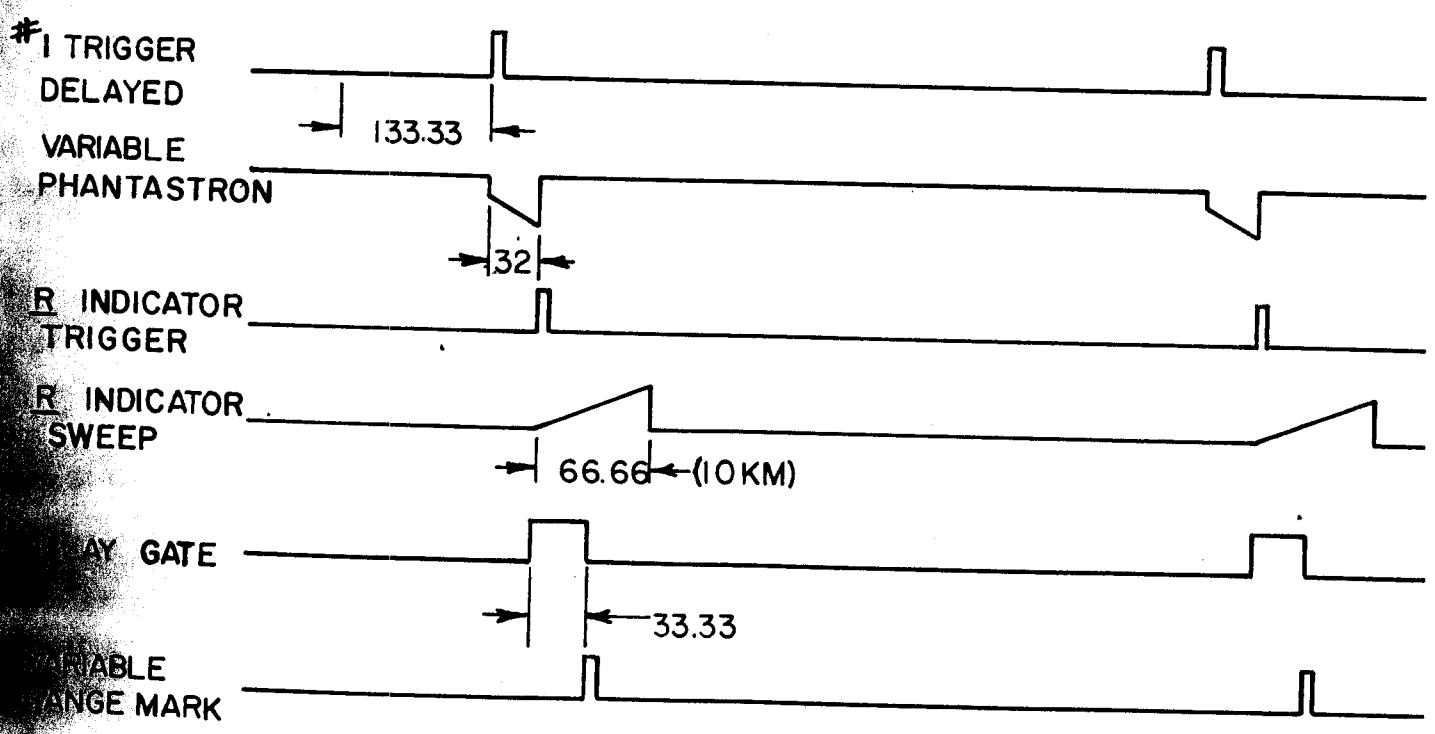


Figure #17. Trigger and Ranging Mark Generator Wave Forms

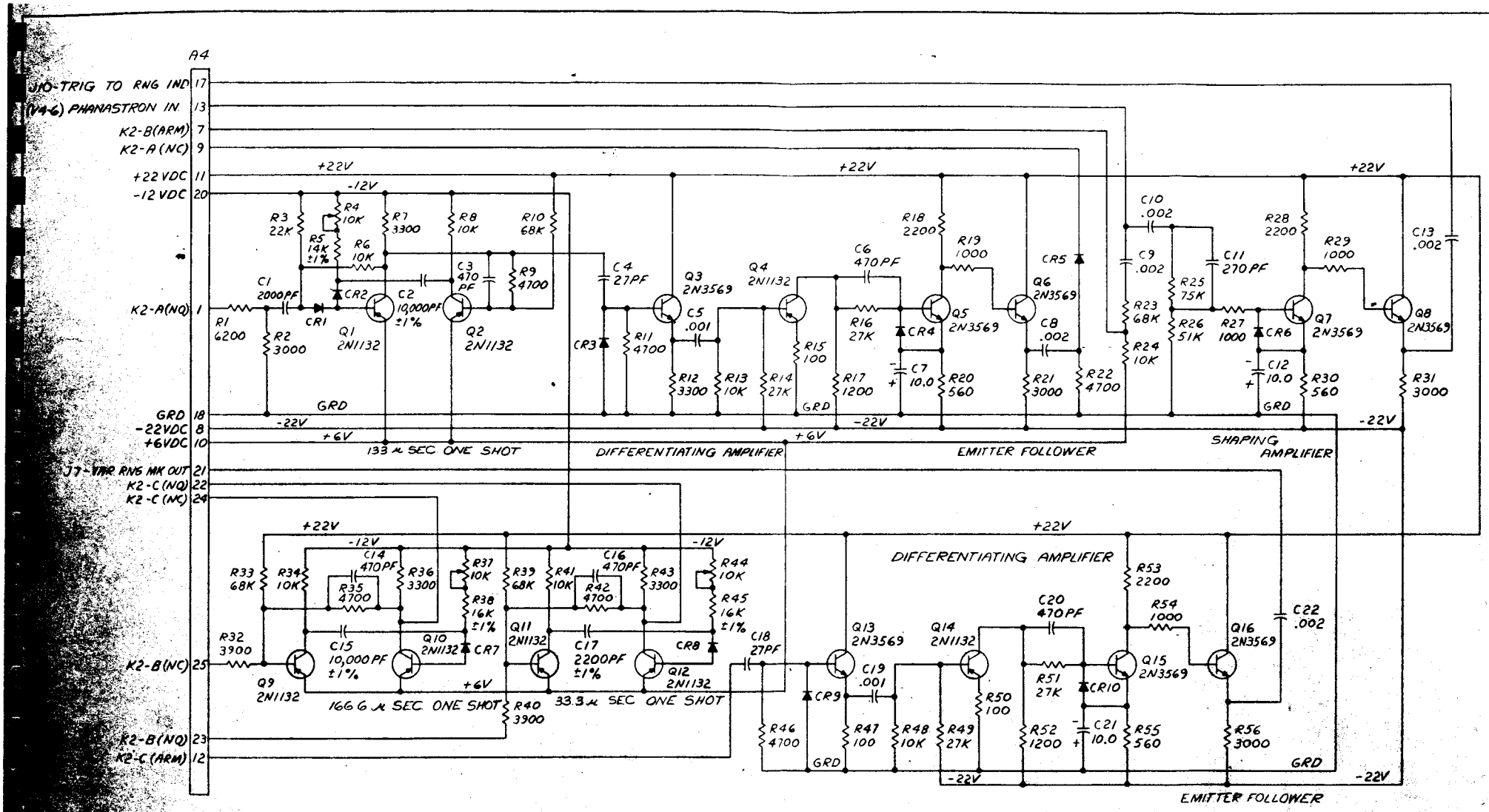


FIG 18

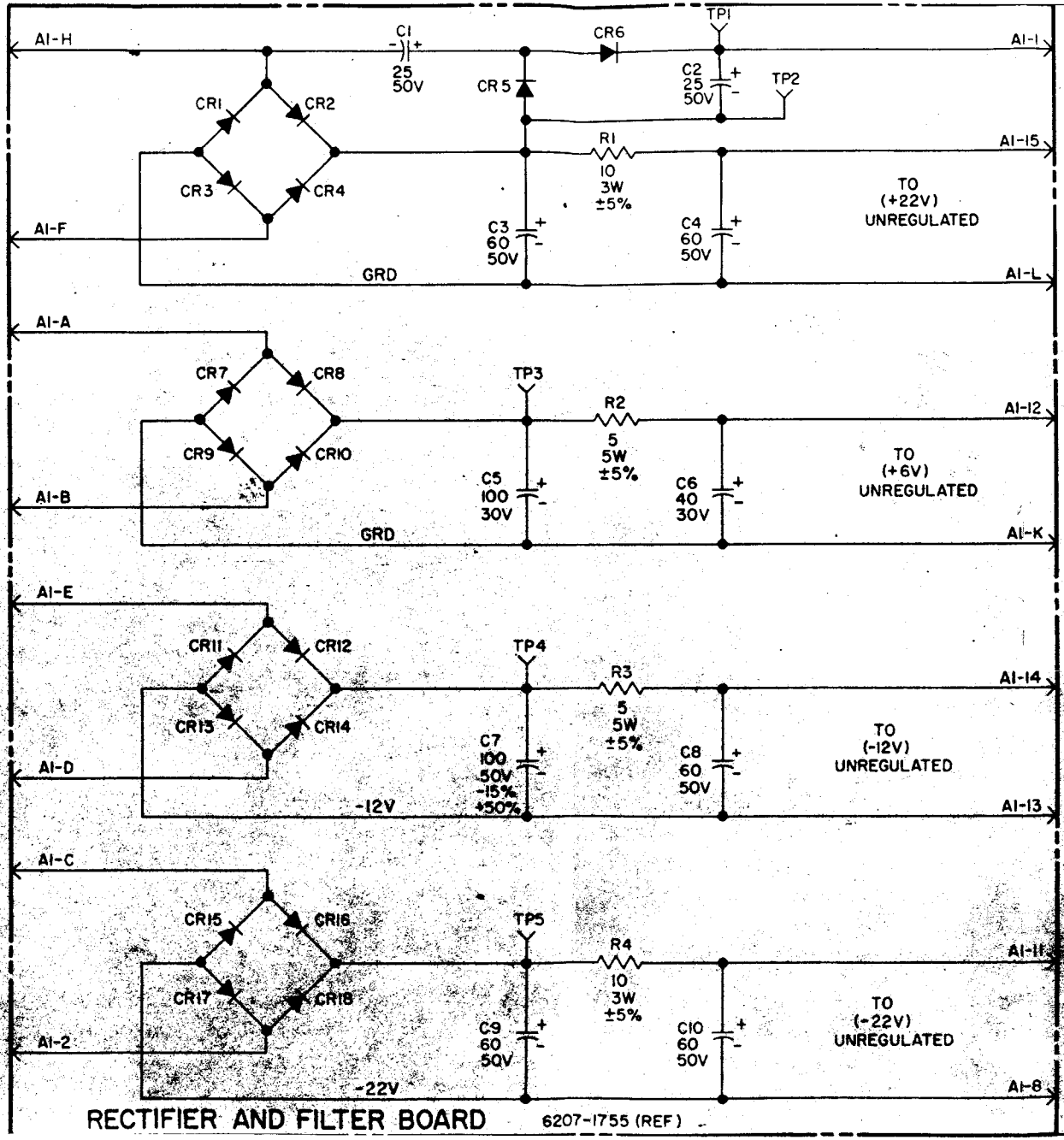
SIERRA Research Corp.

SCHEMATIC DIAGRAM, TRIGGER & RANGE MARK GENERATOR (6A4)

CODE IDENT NO. 12115 | SIZE D | 6510-0064

SCALE NONE | CONTR NO. | SHEET 1 OF 1

N. Kogita 11/19/65



RECTIFIER AND FILTER BOARD 6207-1755 (REF)

CONNECTIONS

4 ALL LEADS TO A2

3. ALL REF DESIGNATIONS ON BOARD ARE PREFIXED BY 6A1

2. ALL DIODES ARE 1N3189

1. UNLESS OTHERWISE SPECIFIED:
ALL CAPACITORS IN UF, ±20%, 50V
ALL RES IN OHMS, ±5%, 5W

NOTES:

FIG. 19

N. Koyata
29 Nov 1965

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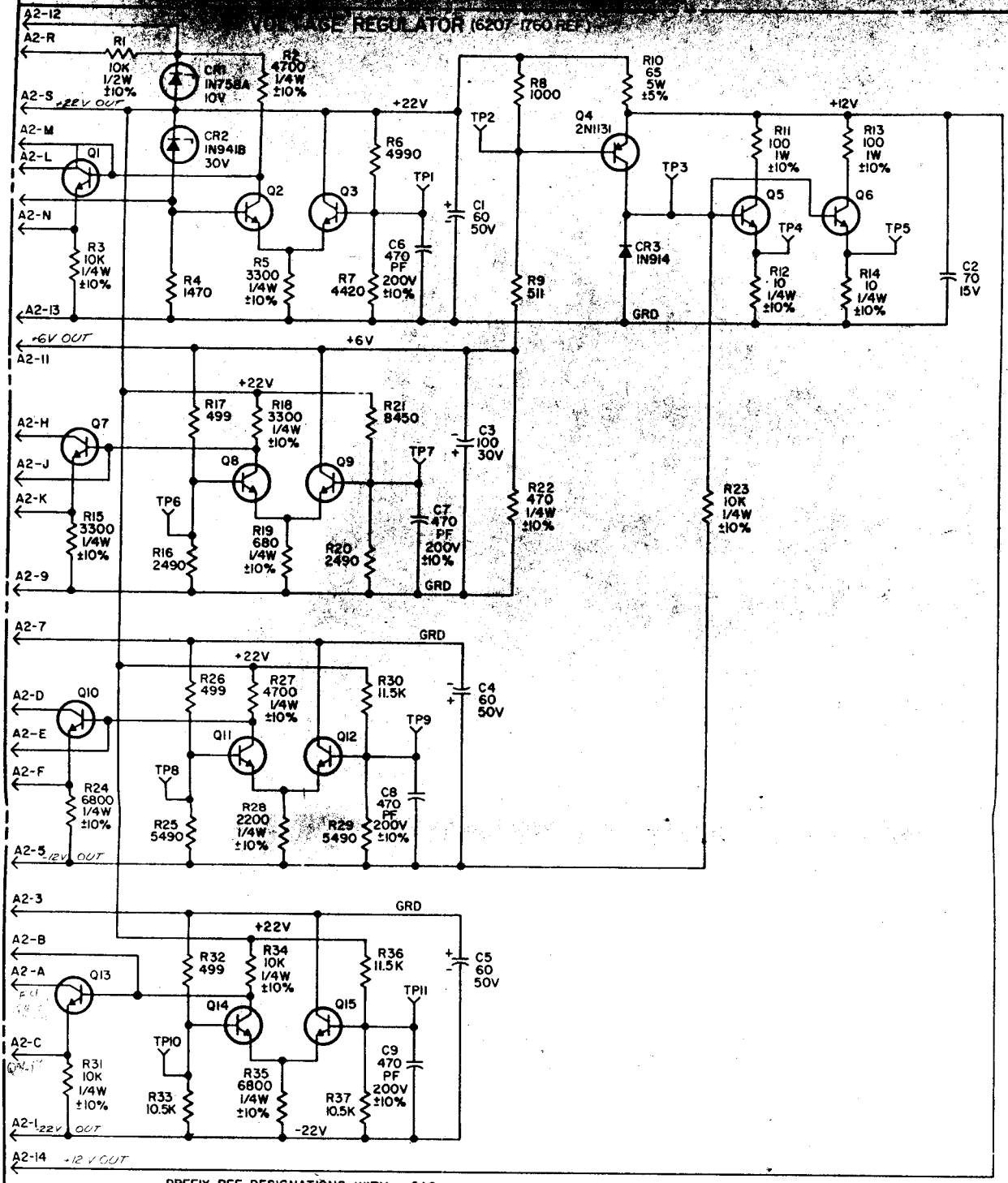
SCHEMATIC DIAGRAM, RECTIFIER & FILTER BOARD (6A1)

CODE IDENT NO.	SIZE	
12115	C	6510-0061
SCALE NONE	CONTR NO.	SHEET 1 OF 1



PREFIX REF DESIGNATIONS WITH 6A2

NOTES:

1. UNLESS OTHERWISE SPECIFIED:
   ALL DIODES ARE IN3189
   ALL CAPACITORS ARE IN UF, ±20%
   ALL RESISTORS ARE IN OHMS, 1/8W, ±1%
   ALL TRANSISTORS ARE 2N1711M

N. Kegg 29 JAN 1965

SIERRA Research Corp.

SCHEMATIC DIAGRAM, VOLTAGE REGULATOR (6A2)

CODE IDENT NO. 12115 | SIZE D | 6510-0062 | SHEET 1 OF 1

FIG #20

SECTION VII
CPS-9 CONSOLE AND DISPLAY MODIFICATIONS

A. GENERAL WIRING CHANGES

To facilitate system wiring, the original CPS-9 console wiring scheme has been kept intact as much as possible. The pick-up of all existing CPS-9 power and signal functions are shown, where applicable, in the function diagrams of this handbook. (Refer to figures 15 and 21.)

B. CONSOLE MODIFICATIONS

The major modifications of the CPS-9 console proper were in the indicator displays. The largest of these being the rebuilding of the original "B" type indicator into an RHI type indicator that is identical to the original supplied RHI indicator No. 1.

To understand the basic modifications performed by Sierra Research Corporation, a brief description of these units follows.

1. A/R Indicator

A new wafer section has been added to the range selector switch of this unit. The fused 115 vac, 60-cycle (CPS-9) from transformer T1 (A/R indicator) is connected to the arm of the added wafer section. When the range selector switch is placed in the 10 KM position, 115 vac energizes relay K2 located in the range data and readout unit. Relay K2 then switches the proper 1 sh sweep delay multivibrator for the ±10 KM sweep range.

2. PPI Indicator

Only two modifications to this unit were made:

a. Removal of the sector scan switch and sector width potentiometer.

b. The addition of a 30:1 speed reducer in series with the azimuth position handwheel and the replacement of the original azimuth position differential synchro with a new transmitting synchro.

3. "B" Indicator Modified to RHI Indicator No. 2

As stated previously, the new RHI indicator is electrically the same as the original supplied RHI No. 1. Reference is thus made to the original

CPS-9 manual for theory of operation and schematic diagrams.

It should be stated at this time that both RHI indicators are physically interchangeable with one another and that the sine-cosine voltage adjustments must be made at RHI No. 1 only.

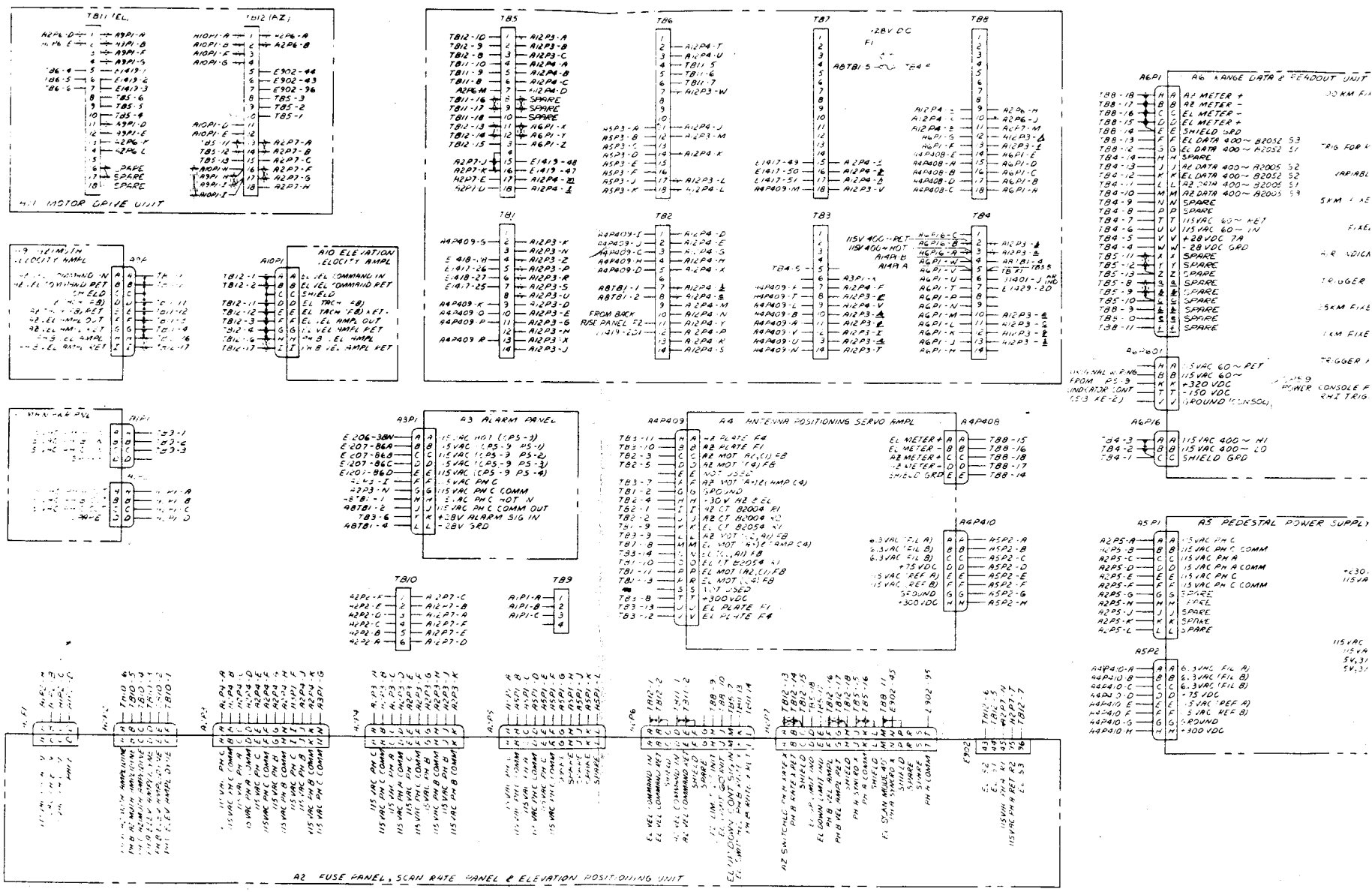
4. CPS-9 Power Supply

In order to furnish the proper voltages to RHI indicator No. 2 several of the B+ voltages were obtained from this unit and run directly to the indicator power connector.

In order to obtain a visual indication that one of the four power supply fuses had blown, the original fuseholders were replaced with indicating type fuseholders and were relocated to the console alarm panel. (See figure 22.)

5. Elevation Position Handwheel Assembly

This unit remains intact with the exception of the replacement of the originally supplied differential synchro with a new transmitting synchro.


A2 FUSE PANEL, SCAN RATE PANEL & ELEVATION POSITIONING UNIT
A4 ANTENNA POSITIONING SERVO AMPL
A3 ALARM PANEL
A6 RANGE DATA & READOUT UNIT
A5 PEDESTAL POWER SUPPLY
A1 MOTOR DRIVE UNIT
A10 ELEVATION VELOCITY AMPL
+28V DC
TB5
TB6
TB7
TB8
TB1
TB2
TB3
TB4
TB9
TB10
TB11 (EL)
TB12 (AZ)

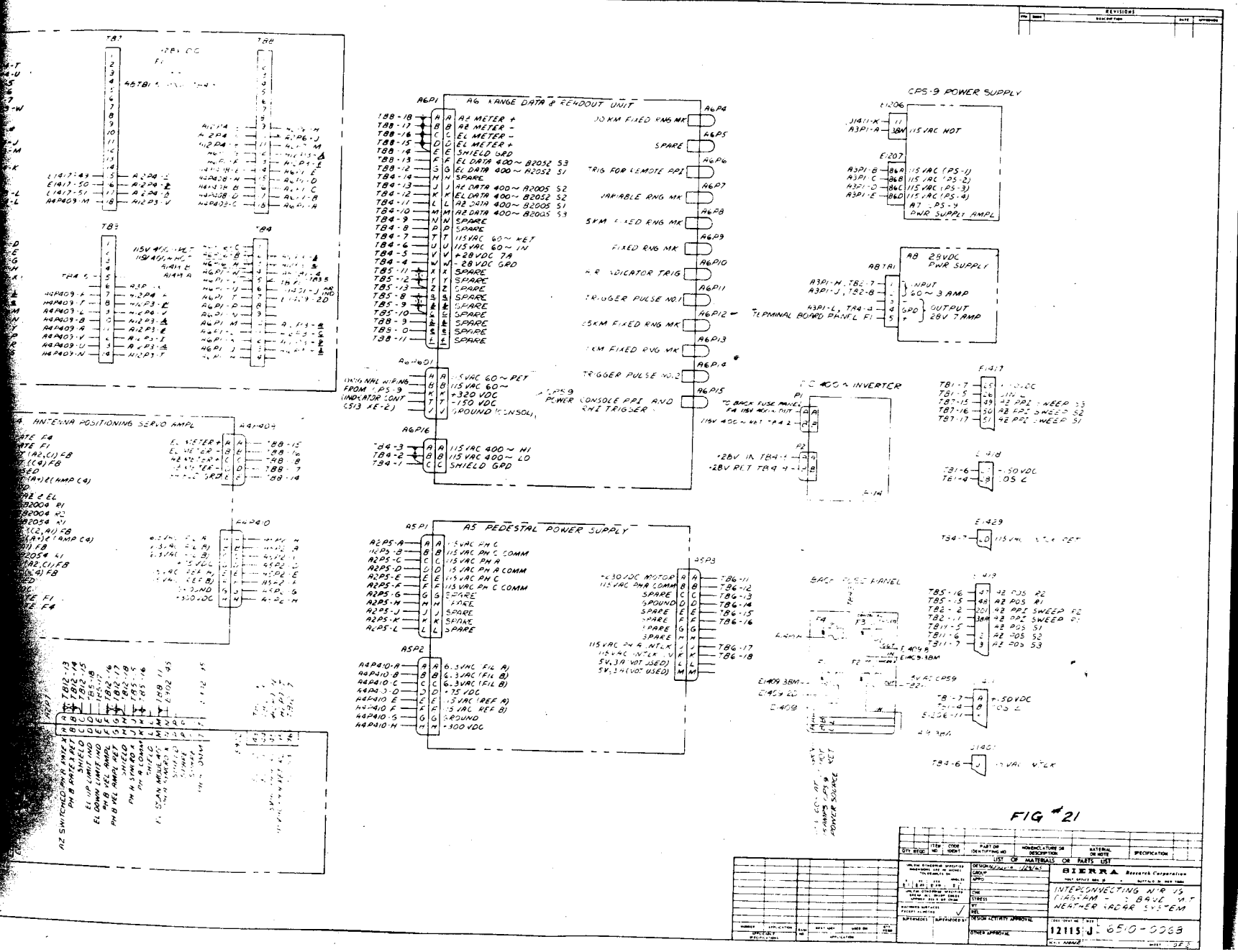


FIG # 21

QTY. REQD	ITEM NO.	CODE IDENT	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL OR NOTE	SPECIFICATION

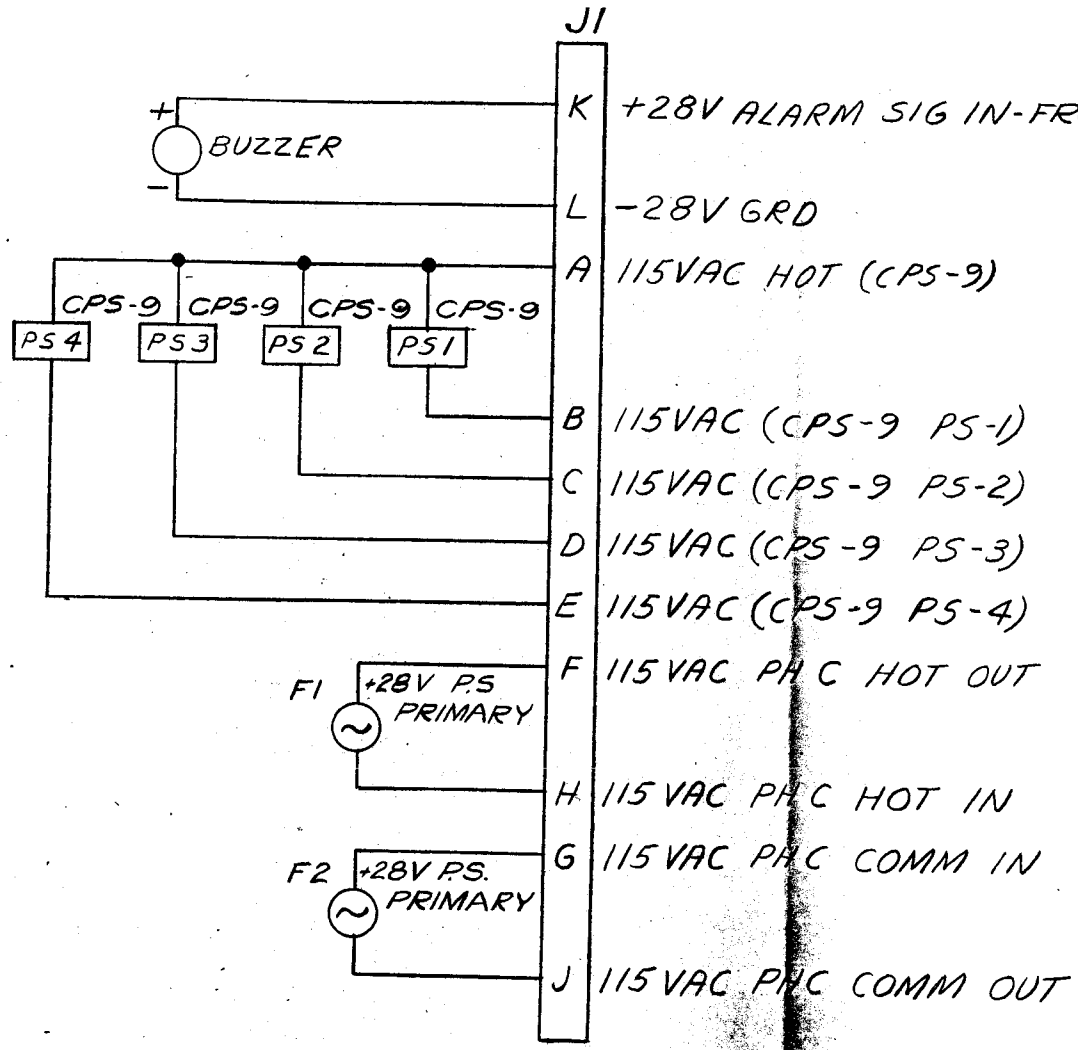
LIST OF MATERIALS OR PARTS LIST

SIERRA Research Corporation

INTERCONNECTING WIRING DIAGRAM - BASIC SYSTEM WEATHER RADAR SYSTEM

12115 J 6510-5068

SHT 3 OF 3



N. Koguta
29 Nov 1965

ELECTRONICS SIERRA Research Corp.
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SCHEMATIC DIAGRAM,
ALARM PANEL
(A3) FIG. #22

CODE IDENT NO.	SIZE	
12115	B	6510-0057
SCALE NONE	CONTR NO.	SHEET 1 OF 1

SECTION VIII
ANTENNA SYSTEM POSITIONING SERVO ADJUSTMENTS

A. REQUIRED TEST EQUIPMENT

To insure proper servo operation of the positioning system, the following alignment procedure should be made. (All voltage readings are taken with a suitable 20K ohm per volt meter.)

Note: Before any adjustments are made, power should be applied to the system for at least 15 minutes.

1. Amplidyne Balancing

a. Turn both elevation and azimuth amplidyne power switches located on the scan rate panel ON.

b. Place meter function switch to +300 vdc range or higher. Place + meter probe in one of the elevation control field test point. Place - meter probe in ground test point.

Adjust the elevation balance control so the voltage read at each of the control field test points to ground is the same. Reading should be approximately +280 volts. Repeat same procedure in the azimuth channel.

2. Positioning Servo Amplifier

a. Turn both elevation and azimuth amplidyne power switches on scan rate panel to the OFF position.

b. Check the d-c voltage from jack J413 (+30 v) to either jack J411 (AH) or jack J412 (AH). Voltage should be adjusted to +7 vdc by means of the AH limiting control.

c. Check the d-c voltage from J413 (+30) to J414 (torque). Reading should be from 3 to 4 volts. Adjust the voltage, if necessary, by means of torque control R433.

d. Check voltage for J413 (+30) to ground. Voltage should be between 25 and 30 volts.

e. Turn both elevation and azimuth amplidyne power switches to ON position.

f. Observing the elevation error meter on the range data and readout unit, check for a reading of 2.5 volts. If reading is more than ±0.2 volts off, adjust current control R458.

g. Repeat above step and observe the azimuth error meter. Make necessary adjustment by current control R408.

h. Set both elevation and azimuth AH gain controls to 4.

3. Elevation and Azimuth Velocity Amplifier Adjustments

a. Place elevation scan speed control on scan rate panel to the extreme CCW position.

b. Place elevation scan switch on same panel to ON position.

c. Observe elevation data readout unit located on the range data and readout panel. No movement of the antenna should be noted. If antenna indicates a slow drift, adjust the hum balance control on the elevation velocity amplifier for zero antenna drift.

d. Repeat above two steps observing the azimuth data readout unit. Make any required adjustments to the hum balance control on the azimuth velocity amplifier.